The British Mycological Society

(*Recognosce notum, ignotum inspice*)

TRANSACTIONS

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TRANSACTIONS

Volume XXIV

Edited by
J. Ramsbottom, B. Barnes and H. Wormald

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THE ARUNDEL FORAY

19–20 May 1939

BY C. G. C. CHESTERS

THE President, Mr E. W. Mason, and a small party of members gathered at the Norfolk Hotel on Friday evening, 19 May 1939, for the spring foray. The weather was dry and warm and did not inspire those present with the hope of extensive collections of fungi during the week-end.

On Saturday and Sunday the lower and upper reaches, respectively, of Rewell Wood were visited. The fungi collected during Saturday were mainly common species. *Geaster fimbriatus* was found under some conifers on the west ridge of the wood. On Sunday certain interesting finds were recorded. After some search *Nummularia lutea*, on box, was discovered in quantity near the site at which it had been collected previously but *Rosellinia Buxi* which was then found with it on that host was not observed on this foray. In the beeches on top of the west ridge *Hypoxylon cohaerens* was plentiful on some of the lying timber and *H. rubiginosum*, more characteristic of ash, was quite abundant on fallen beech branches. *Nummularia Bulliardi* was a worth-while find on some smaller branches of beech on the west side of this ridge.

Paine's Wood was visited on Monday and provided many of the recorded resupinates but was rather dry to yield a crop of micro-fungi.

At a meeting of members held after tea on Sunday it was decided that the spring foray in 1940 should be held, if possible, in the Marlborough district. The President proposed that a hearty vote of thanks be accorded to His Grace the Duke of Norfolk for permission to visit and collect in Rewell Wood and Paine's Wood. This was carried with acclamation.

Because of the adverse weather conditions the list of species is very short, and I am indebted to Mr Mason, Mr Pearson, Dr Smith and other members present for their records on which this list is based.

*List of species gathered during the Foray**

A. = Arundel; *P.* = Paine's Wood; *R.* = Rewell Wood.

HYMENOMYCETES

Armillaria mellea (Vahl) Fr. (rhizomorphs), *P.*, *R.*, mucida (Schrad.) Fr., *A.*
Auricularia auricula-Judae (Linn.) Schroet., *A.*, *R.*, mesenterica (Dicks.) Fr., *A.*, *R.*
Bourdotia Eyrei Wakef., *A.*
Coprinus micaceus (Bull.) Fr., *A.*, *R.*
Corticium Sambuci (Pers.) Fr., *A.*, tulasnelloideum v. H. & L., *A.*
Cortinarius (Hydrocybe) castaneus (Bull.) Fr., *A.*
Dacromyces deliquescens (Bull.) Duby, *A.*, *R.*
Daedalea quercina (Linn.) Fr., *A.*, *P.*
Eichleriella spinulosa (Berk. & Curt.) Burt., *A.*
Exidia Thuretiana (Lév.) Fr., *A.*
Fomes annosus Fr., *A.*, *R.*, ferruginosus (Schrad.) Mass., *A.*
Galera tenera (Schaeff.) Fr., *A.*
Gleocystidium porosum Berk. & Curt., *A.*, praetermissum (Karst.) Bres., *A.*
Grandinia farinacea (Pers.) Bourd. & Galz., *A.*
Hymenochaete rubiginosum (Dicks.) Lév., *A.*, tabacina (Sow.) Lév., *P.*
Hypholoma fasciculare (Huds.) Fr., *A.*, *P.*, sublateritium (Schaeff.) Fr., *P.*
Irpex obliquus (Schrad.) Fr., *A.*
Lenzites betulina (Linn.) Fr., *A.*
Marasmius funicularis (Fr.) Rea, *A.*, dryophilus (Bull.) Karst., *A.*, *P.*, *R.*
Merulius rufus (Pers.) Fr., *A.*
Naucoria semi-orbicularis (Bull.) Fr., *A.*
Odontia papillosa (Fr.) Bres., *A.*
Panus stipticus (Bull.) Fr., *A.*
Peniophora cinerea (Fr.) Cke., *A.*, crema Bres., *A.*, glebulosa Bres., *A.*, hydnoides Cke. & Mass., *A.*, laevigata (Fr.) Mass., *A.*, longispora (Pat.) Fr., *A.*, setigera (Fr.) Bres., *A.*, velutina (DC.) Fr., *A.*
Pholiota marginata (Batsch) Fr., *A.*, togularis (Bull.) Fr. *A.*
Pleurotus sapidus Schulz. *A.*, *R.*
Polyporus adustus (Wild.) Fr., *A.*, betulinus (Bull.) Fr., *R.*, caesius (Schrad.) Quél., *A.*, squamosus (Huds.) Fr., *A.*, *R.*
Polystictus versicolor (Linn.) Fr., *A.*, *P.*
Poria farinella Fr., *A.*
Psathyra fatua Fr., *A.*, obtusata Fr., *A.*
Solenia anomala (Pers.) Fr., *P.*, candida (Hoffm.) Fr., *A.*
Stereum hirsutum (Willd.) Fr., *A.*, *P.*
Trametes mollis (Sommerf.) Fr., *P.*, *R.*
Tremella mesenterica (Retz.) Fr., *P.*
Tricholoma gambosum Fr., *A.*

GASTEROMYCETES

Geaster fimbriatus Fr., *R.*

UREDINALES

Kuehneola albida Magnus, *R.*
Melampsora Euonymi-caprearum Kleb., *R.*
Puccinia Buxi DC., *R.*, obtegens (Link) Tul., *A.*, Violae (Schum.) DC., *R.*

* In some instances, where no precise location for a species had been given, it is listed under Arundel, thus covering both Rewell Wood and Paine's Wood.

USTILAGINALES

Urocystis Anemones (Pers.) Schroet., *P.*

PYRENOMYCETES

Anthostoma gastrinum (Fr.) Sacc., on *Ulmus*, *R.*
Cryptosphaeria eunomia (Fr.) Fuck., *R.*
Daldinia concentrica (Bolt.) Ces. & de Not., *R.*
Diatrype disciformis (Hoffm.) Fr., *P.*, *R.*, Stigma (Hoffm.) Fr., on *Fagus*, *P.*, *R.*, on *Corylus*, *R.*
Diatrypella favacea (Fr.) Ces. & de Not., on *Betula*, *R.*, on *Corylus*, *R.*, on *Fagus*, *P.*, *R.*
Eutypa spinosa (Pers.) Tul., on *Fagus*, *R.*
Eutypella stellulata (Fr.) Sacc., on *Ulmus*, *R.*
Hypoxylon coccineum Bull., *P.*, *R.*, cohaerens (Pers.) Fr., *R.*, fuscum (Pers.) Fr., on *Corylus*, *P.*, *R.*, Howieanum Pk., on *Corylus* and *Aesculus*, *P.*, rubiginosum (Pers.) Fr., on *Fraxinus* and *Fagus*, *P.*, *R.*, semi-immersum Nits., *R.*, serpens (Pers.) Fr., on *Fraxinus* and *Aesculus*, *P.*, on *Fagus*, *R.*
Melanomma Pulvis-pyrius (Pers.) Fuck., on *Fraxinus*, *R.*
Nummularia Bulliardi Tul., on *Fagus*, *P.*, lutea (A. & S. ex Fr.) Nits., *R.*
Pseudovalsa lanciformis (Fr.) Ces. & de Not., *R.*
Quaterneria dissepta (Fr.) Tul., *R.*, quaternata (Pers.) Schroet., *P.*, *R.*
Strickeria obducens (Fr.) Wint., *R.*
Ustulina vulgaris Tul., on *Fagus*, *P.* (conidial), *R.*
Xylaria carpophila (Pers.) Fr., *R.*, Hypoxylon (Linn.) Grev., *P.*, *R.*

DISCOMYCETES

Chlorosplenium aeruginosum (Oeder.) de Not., *mycelium*, *P.*
Ciliaria scutellata (Linn.) Quél., *A.*, *R.*
Dasyscypha nivea (Hedw. fil.) Sacc., *A.*, virginea (Batsch) Fuck., on *Fagus*, *R.*
Hyalina inflatula (Karst.) Boud., *A.*
Molisia cinerea (Batsch) Karst., *P.*, *R.*
Orbilia leucostigma Fr., *R.*

DEUTEROMYCETES

Coniothecium betulinum Corda, *R.*
Torula antennata Pers., on *Fraxinus*, *P.*, *R.*
Tuberculina persicina (Ditm.) Sacc., *R.*

MYCETOZOA

Ceratiomyxa fructiculosa Macbr., *R.*
Lycogala epidendrum Fr., *R.*

PHYTOPATHOLOGICAL EXCURSION, 1939

By G. C. AINSWORTH

The sixteenth annual Phytopathological Excursion took the form of a visit to the Hawthorndale Laboratories at the Jealott's Hill Research Station on Saturday, 17 June. The kindness of Imperial Chemical Industries, Ltd., in making this visit possible, and their generosity in providing lunch and tea, were greatly appreciated by a party of about thirty members and friends.

The principal feature of the day was a series of demonstrations and exhibits of the methods by which new and improved fungicides are evolved. The first stage takes place in the laboratory where each year many hundreds of compounds are subjected to certain routine tests to ascertain their fungicidal value against several common parasitic and saprophytic fungi. A small number of the more promising compounds are given a more extensive laboratory study but few reach the stage of small scale greenhouse trials and even fewer the experimental field trials.

Different classes of fungicides, such as wood preservatives and cereal grain disinfectants, are elaborated in different sections of the laboratories, and studies are also made on the effects of spreaders and other constituents of commercial sprays and dusts on fungicidal values.

The visitors found many details of interest in the laboratory, greenhouses and field and spent an enjoyable day.

ANNUAL MEETING

16 December 1939

OWING to the outbreak of war and the consequent difficulties of road transport the Council decided that it was not advisable to hold the Annual General Meeting and Autumn Foray which had been arranged for 25–30 September at Chipping Campden. Also the remainder of the 1939 programme—three Saturday forays and the November London meeting—had to be abandoned.

The postponed Annual Meeting was held on 16 December 1939, in the rooms of the Linnean Society at Burlington House, Piccadilly, by kind permission of the President and Council.

Dr H. Wormald was elected President for 1940. The retiring President, Mr E. W. Mason, the immediate past President, Miss K. Sampson, and Mr W. C. Moore were elected Vice-Presidents. The other officers and the editors were re-elected. The three new members of Council elected were Miss E. M. Blackwell, Dr G. E. Deacon, and Dr P. H. Gregory. The names of the proposed members of the Phytopathological Committee were read out and agreed to.

The Treasurer's statement was adopted.

It was decided to carry out a programme for 1940 as near normal as possible, though it was considered inadvisable to hold a Spring Foray or the usual day Forays. Two meetings will be held in London in spring, and one in autumn; the Phytopathological Excursion will also be arranged.

In a discussion on the place for the Autumn Foray it was agreed that somewhere should be chosen with collecting grounds within walking distance. Symonds Yat, Painswick, Arundel and Windsor were put forward as suggestions to be considered by the officers.

Dr René Maire, the eminent French mycologist, was proposed as honorary member by Mr Carleton Rea and seconded by Mr A. A. Pearson. He was elected with enthusiasm and unanimity.

After lunch the President, Mr E. W. Mason, M.A., F.L.S., gave his address "On specimens, species and names", after which tea was served.

The meeting was very well attended and members made full use of the much appreciated opportunity for discussing mycological, personal and international affairs.

J. RAMSBOTTOM.

RECEIPTS AND PAYMENTS FOR THE YEAR ENDING 30 JUNE 1939

Date	Receipts	£	s.	d.	Date	Payments	£	s.	d.
1938 1 July.	Balance brought forward ...	637	11	10	1939 30 June.	Cambridge University Press, Cost of 450 vol. XXII *Transactions* and Reprints ...	497	2	7
1939 30 June.	Subscriptions to date ...	329	6	8		Postage, Stationery, etc.:			
	Gifts to Printing Fund ...	4	8	0		Treasurer ...	2	10	9
	Sale of *Transactions*:					Secretary...	4	6	5
	Current volumes ...	105	16	6		Sec. Pathological Committee ...	3	1	0
	Back volumes ...	36	3	5		Editors ...	2	2	8
	Sale of Reprints ...	27	1	0		Purchase of Addressograph ...	4	6	0
	Profit from sale of C. Rea's *British Basidiomycetae* ...	7	7	11		Sundry Printing ...	4	19	6
	Deposit Interest ...	3	5	0		Fees of Meetings ...	6	3	6
	War Loan Interest...	17	10	0		Cheesman Fund Allowance ...	5	0	0
						Balance in hand and on deposit ...	638	17	11
		£1168	10	4			£1168	10	4

CAPITAL ACCOUNT—Robinson Bequest, £50; Cheesman Fund, £150; Printing Fund, £300; invested in 3½% War Loan

A. A. PEARSON, *Hon. Treasurer*

Examined and found correct, F. G. GOULD, 25 July 1939

The following have kindly sent gifts to the Printing Fund:

Name	£	s.	d.	Name	£	s.	d.
				Brought forward...	2	7	6
Mr F. J. Barrington ...		5	0	Mrs A. Montague ...		5	6
Mr W. H. Edwards ...		5	0	Dr G. Morgan ...		10	0
Mr G. C. Hughes...		5	0	Dr G. H. Pethybridge ...		10	0
Col. C. T. Green ...		2	6	Prof. M. C. Potter ...		10	0
Dame Helen Gwynne Vaughan ...		10	0	Mr E. W. Swanton ...		5	0
Miss G. Lister ...	1	0	0				
	£2	7	6		£4	8	0

Some subscriptions are still unpaid. Please remit to the Hon. Treasurer.

A CHYTRID ALLIED TO *PLEOLPIDIUM INFLATUM* BUTLER

By GRACE M. WATERHOUSE
Royal Holloway College

(With 8 Text-figures)

AMONG the species of the Chytridiaceous genus *Pleolpidium* discovered by Butler (1907) infecting *Pythium intermedium*, one was described which differed from the others in having biflagellate zoospores. The species was named *Pleolpidium inflatum* pending the discovery of the resting spores, though Butler remarked that the two flagella separated it widely from the other species of the genus. Since this first description there has been, so far as I can ascertain, no printed record of its recurrence, though Dr F. K. Sparrow has written to say that he once found it in Paris. The present appearance of a similar parasite in this country is therefore interesting.

The parasite enters the host by means of zoospores which pierce the hyphal wall. The protoplasm passes in, mingles with that of the host and is indistinguishable from it. The sporangium of the parasite forms within what presumably would have been a sporangium of the host. The parasitic sporangium completely fills the host sporangium, and its wall is intimately fused with that of the host. The parasite causes little change in the form of the host apart from occasional hyphal swellings and a difference in the shape of the sporangium.

The parasite appeared in January 1938 during an investigation of the water moulds of the Hogsmill River (a Surrey tributary of the Thames), on a mould growing on tomato and grape skins in three separate cultures kept in different places. The tomatoes and grapes had been used either as bait in the river or for reinoculation experiments in the laboratory. After the fruits had broken up, the skins were kept from November to the end of January in glass jars with frequent changes of tap water and examined at intervals to ascertain whether any other moulds had appeared. During the fortnight preceding the appearance of the parasite, there had been an abundance of a proliferating species of *Phytophthora* on the grape. When the parasitic sporangia were noticed, portions of infected skin were transferred to Quaker Oat agar plates, and a good growth of the parasitized fungus was obtained. The host when separated from the parasite was found to resemble *P. cryptogea*.

Description of the parasitized fungus

On the fruit skins the hyphae were finer ($2 \cdot 5\mu$ diam.) and the sporangia smaller than in culture, and pyriform (30μ long). There was little hypertrophy of the host hyphae. On Quaker Oat agar the hyphae were much coarser (up to 8μ diam.) and often swollen below the sporangium (Fig. 2 B). The hyphae were non-septate except in the older parts. Parasitized sporangia were produced sparingly on Quaker Oat agar, but when the plate was flooded with water, very numerous sporangia developed (600–800 per sq. cm., Fig. 1). They varied very much in shape and size, being pyriform or oval in fresh cultures (Fig. 2 A), and oval or spherical in older cultures (Fig. 2 C) (variation 25–74×18–48μ, the usual size being about $38 \times 32\mu$). The

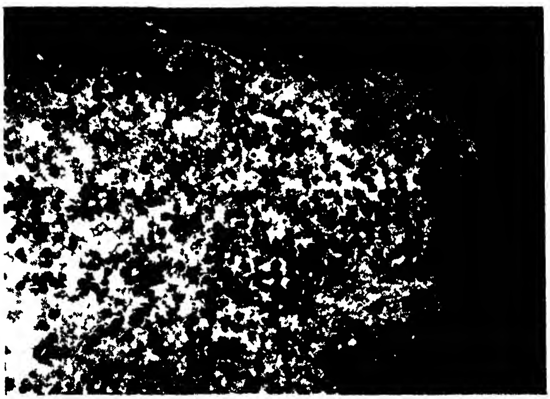

Fig. 1. Photomicrograph of a portion of an agar culture of the parasitized fungus showing the large numbers of sporangia produced after flooding with water, $\times 30$.

sporangia were always terminal whether on the main hyphae or on short lateral branches. No intercalary ones were ever observed, and there was no sympodial growth or proliferation through empty sporangia. The wall of the sporangium was thick, about double the thickness of that of a normal sporangium of *Phytophthora*. Where the base of the sporangium passed into the supporting hypha there was sometimes a thick plug, 5μ deep (Fig. 2 A), or a hemispherical swelling protruding into the sporangium (Fig. 2 C), or occasionally two transverse walls (Fig. 3). The common wall turned pale purplish red with chlor-zinc-iodine. The inner wall of the sporangium of the parasite could not as a rule be distinguished from that of the host in any part, but in one isolated sporangium in a culture that had become

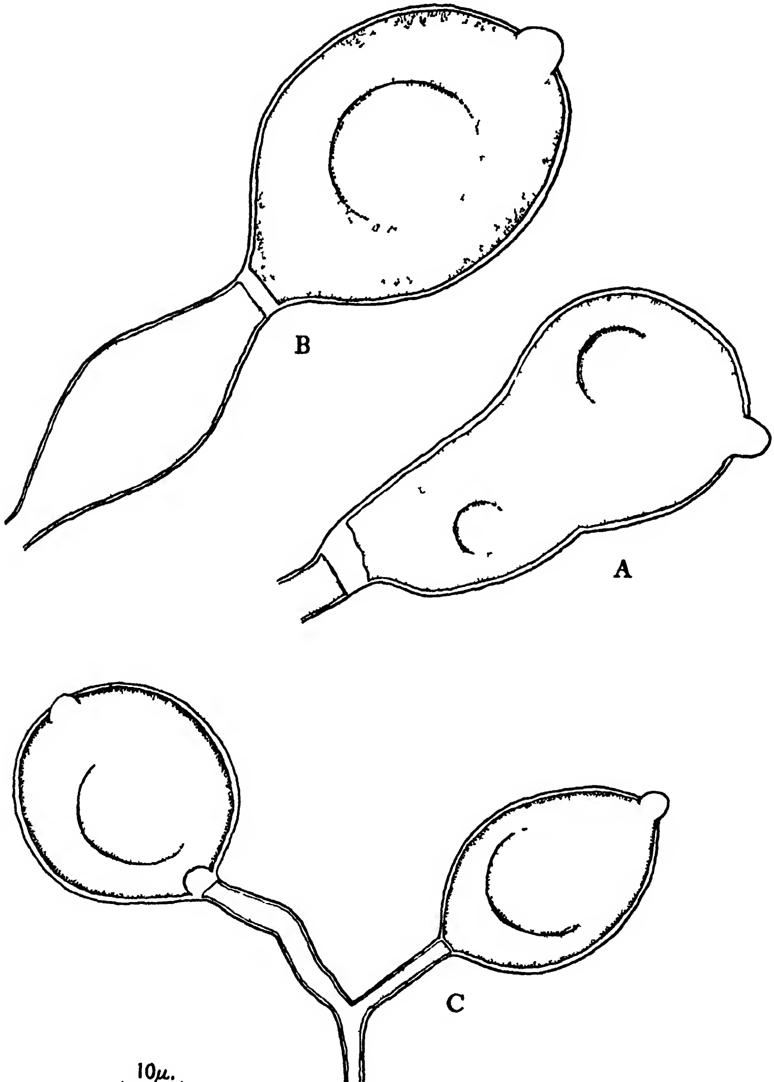

Fig 2 Sporangia of the parasite A The usual shape in fresh cultures B With a swollen supporting hypha C Showing branching and a hemispherical basal plug

partially dried, the entire parasitic sporangium with its papilla had contracted within the host sporangium, and it was outlined by a thin membrane (Fig. 4). The papilla was usually single though there were several examples with two (Fig. 3) and a few with three papillae. The papilla was usually terminal, or occasionally slightly lateral, and was hemispherical, arising so abruptly from the general contour of the

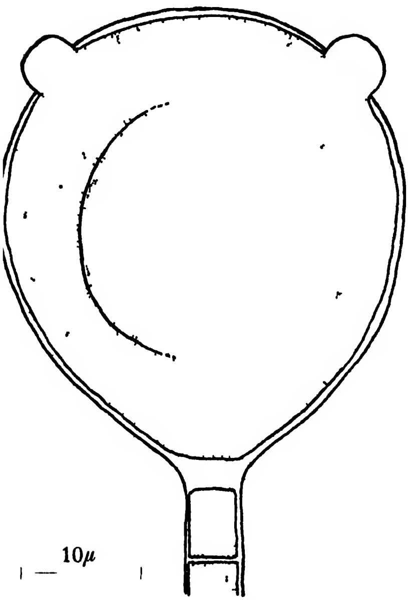

Fig 3 Sporangium with two papillae and a double basal wall

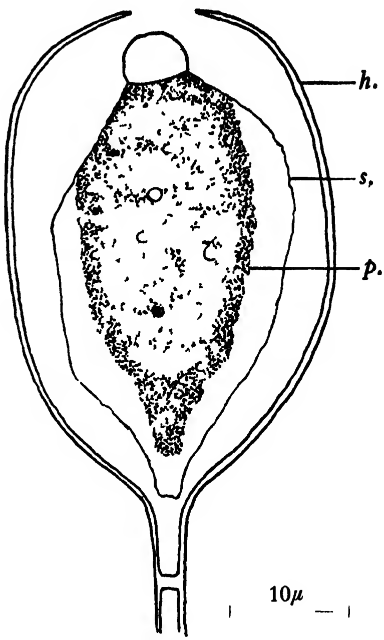

Fig 4 Dried sporangium showing sporangium of parasite contracted within the host wall *h*, host wall, *s*, wall of parasitic sporangium, *p*, protoplasm of parasite

sporangium as to give the appearance of being stuck on. It stained deeply with cotton blue in lactic acid. The protoplasm of the hyphae and young sporangia was granular, and there was nothing to distinguish that of the parasite and host. Soon after the sporangium was delimited the protoplasm became pellucid with a large central vacuole (or occasionally several vacuoles) (Figs. 2, 3).

Development of sporangium of the parasite and emission of zoospores

The development of the parasitic sporangium at a hyphal tip and the emission of zoospores from several sporangia was observed in hanging-drop cultures (Fig. 5). The end of a hypha emerging from a portion of an agar culture began to swell about 4 p.m. By 10.30 the next morning the swelling was spherical and about four times the diameter of the hypha, and was cut off by a transverse wall. The protoplasm, which had been granular, now became clear and vacuoles appeared which changed in shape and moved about. The sporangium reached its full size by the evening, but the papilla did not appear at once and its growth was not observed. Fully developed sporangia mostly contained a large central vacuole. Upon the addition of fresh water the central vacuole dispersed, leaving the protoplasm quite clear except occasionally for a few small dark granules clustered near the centre (Fig. 6 B). Then the protoplasm was seen to be dividing up into what looked like zoospore initials but in ten minutes this appearance had vanished, the protoplasm again becoming clear. It remained so for about half an hour when the papilla vanished, so quickly that it was not observed whether it dissolved into the surrounding water or was drawn into the sporangium; the space which it had occupied in the wall could be seen quite clearly. Soon after this the protoplasm presented a finely reticulate appearance, and it was soon seen that the zoospores were being formed but the initials were much smaller (about a quarter of the size) than those seen earlier on (Figs. 6 D and 7 A, B). When the zoospores were quite clearly defined (in about half to three-quarters of an hour) a heaving movement began and the contents gradually moved round. This movement, very slow at first, gradually became faster until the zoospores were swirling rapidly round. The swarming continued for about ten minutes until suddenly the membrane across the pore left by the papilla burst, and out shot the zoospores at a remarkable speed, giving the effect of a miniature blizzard. The sporangium took some minutes to empty, and in spite of the large number (estimated at 1500–2000 in a medium-sized sporangium), it rarely happened that any zoospores were unable to escape.

It is probable that, owing to the adverse conditions in a hanging drop culture, the times given are somewhat longer than those that would elapse in a Petri dish or in nature.

Zoospores. The zoospores were 5–8μ long and pyriform, with two unequal flagella, the slightly longer one directed anteriorly and the other posteriorly (Fig. 7 D). The protoplasm was clear except for a few bright granules placed centrally or nearer the pointed end. The

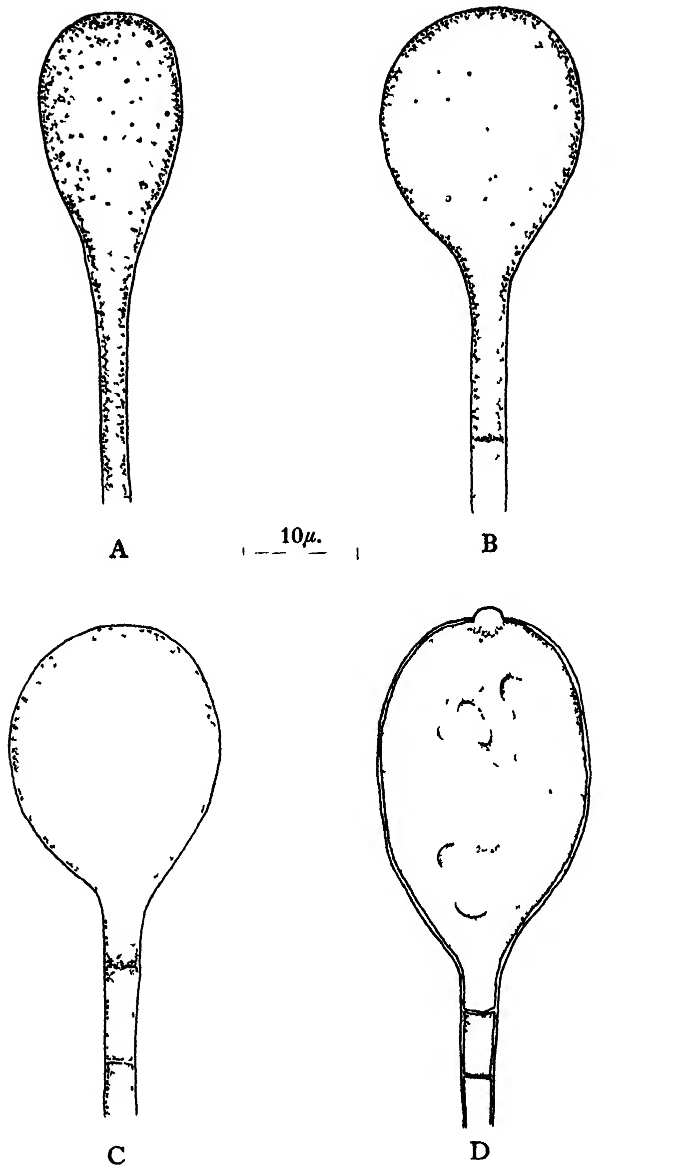

Fig. 5. Development of parasitic sporangium within the host A Swollen hyphal tip, 24 March, 4 p m B Basal wall forming, 25 March, 10 30 a m C Second basal wall forming, 25 March, noon. D Fully formed sporangium with vacuoles continually changing in shape, 25 March, 7 p m

zoospores could swim for twenty-four hours or more if they did not reach suitable hyphae to infect. Many settled down in the water, rounded off and encysted. If, however, young hyphae were present the zoospores were soon seen hanging in rows on them. In be-

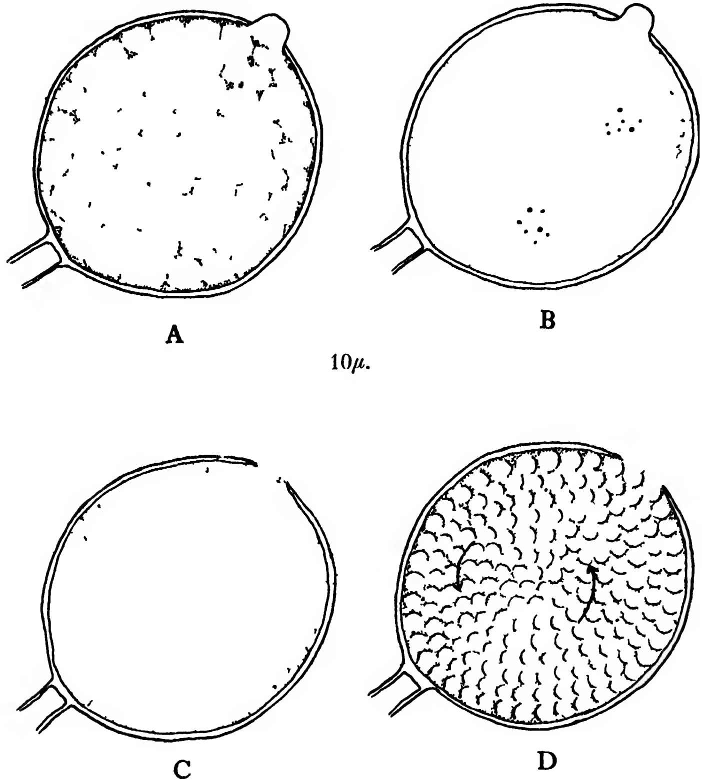

Fig. 6. Development of zoospores of the parasite A Appearance of large initials, 10 45 a m B Resumption of clear appearance, 10 50–11 15 a m C Disappearance of the papilla, 11 20–11 30 a m D Zoospores swarming inside, 12 15–12 45 p m.

coming attached to a hypha the zoospores seemed to hang on by means of the flagellum, the pointed end being directed to the hypha. Penetration was once observed. The zoospore after attaching itself gradually became flattened against the hyphal wall until it was hemispherical (Fig. 8). A slender tube was put out which pierced the wall and then the contents of the zoospore, now entirely granular,

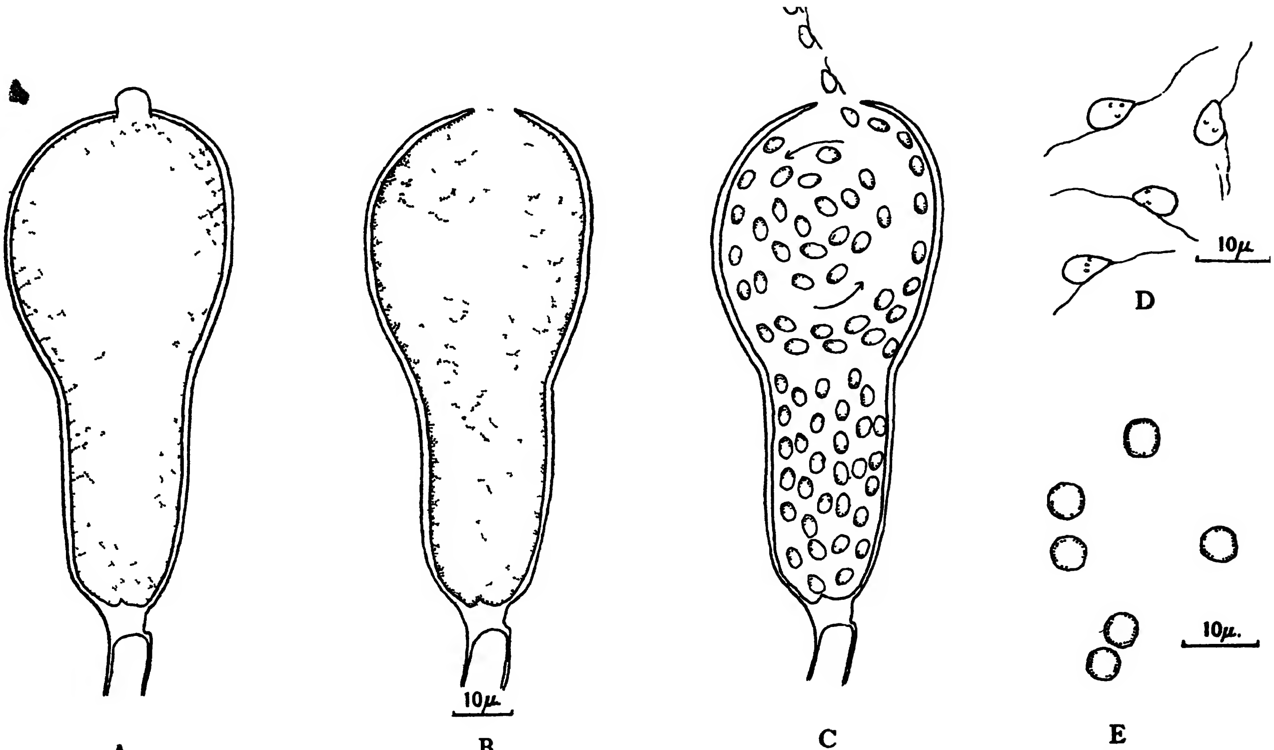

Fig 7 Formation and release of zoospores of the parasite A Reticulate stage, 11 a m B Zoospore initials C Release of zoospores, 1 p m. D Motile zoospores E Encysted zoospores

passed gradually in, taking about twelve hours to do so in a hanging-drop culture. At first the penetrating protoplasm could be seen distinctly but soon it became indistinguishably intermingled with that of the host.

No resting spores were found either on fruit skins or in agar cultures even after two months.

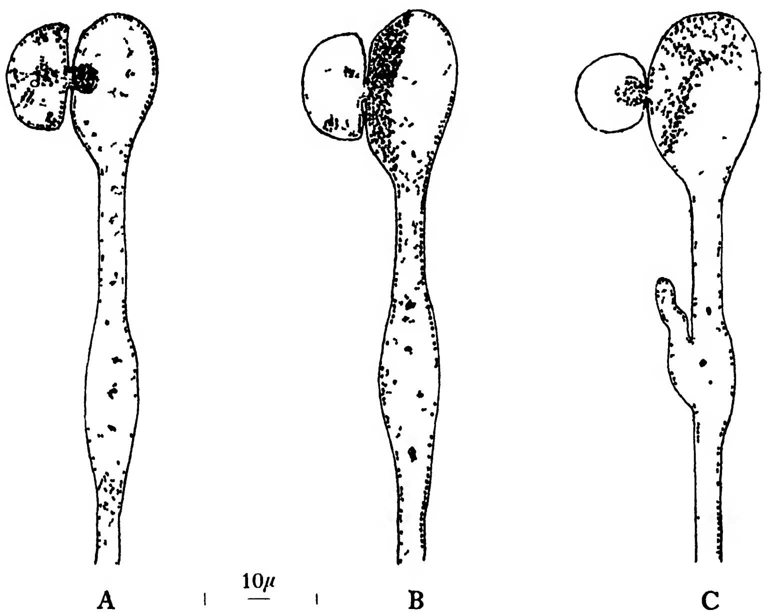

Fig 8 Infection of a hyphal tip of the host by a zoospore of the parasite A, 12 45 p m B, 4 30 p m , C, 10 30 p m

Inoculation experiments

Altogether five inoculation experiments were successful. The hosts used were:

(*a*) The original host (probably *Phytophthora cryptogea*) obtained free from the parasite. This was achieved by taking portions from the edges of agar cultures of the parasitized fungus and transferring them to fresh plates of Quaker Oat agar. Some of these portions contained hyphae of the host not yet infected by the parasite and gave uninfected cultures of the host. These were used for reinoculation experiments with the parasite and three were successful.

(*b*) *Phytophthora megasperma*, obtained originally from a pond near Manchester. This was twice inoculated with the parasite.

Method. Portions were cut from the unparasitized agar culture, put in water and left for a day or two until a radiating hyphal growth had formed. One portion was then halved and to one half (called the host, *H*) was added either a portion of a parasitized agar culture or zoospores of the parasite only; the other half acted as a control (*C*). The water was changed at intervals. The first indication of activity of the parasite was the production or increased production by the host of normal sporangia emitting normal zoospores, the controls showing no such production or increase. The final proof was the production of parasitized sporangia in gradually increasing numbers on the radiating hyphae of the originally uninfected portion.

Details of inoculations of original host

Experiment 1.

3 March.	Portions of uninfected mycelium put in water.
10 March.	Radiating hyphal growth but no reproductive organs. Portions halved, zoospores of parasite put with one half (*H*), other half kept as control (*C*).
12 March.	Normal sporangia on *H*, none on *C*.
15 March.	Normal and parasitized sporangia on *H*: *C* with a few normal sporangia.
30 March.	*H* covered with masses of sporangia of parasite.

Experiment 2.

20 March.	11 a.m. Portions of uninfected mycelium put in water, half (*H*) with parasitized mycelium, half as control (*C*).
20 March.	5 p.m. Numerous normal sporangia on *H*, none on *C*.
22 March.	None as yet on *C*.
24 March.	Parasitized sporangia on *H*: *C* with a few normal sporangia.

Experiment 3.

24 March.	Portion of *C* from Exp. 2 put in water with zoospores of parasite.
1 April.	Parasitized sporangia produced on this portion: rest of *C* with a few normal sporangia.

Details of inoculations of Phytophthora megasperma

Experiment 1.

18 March.	Portion of uninfected mycelium (*H*) put in water with parasitized mycelium: similar portion left as control (*C*).
24 March.	Parasitized sporangia very numerous on *H*: *C* had only sex organs.

Experiment 2.

15 March.	Portion of uninfected mycelium put in water.
20 April.	Radiating hyphae, no sporangia. Fresh water added and a portion of parasitized mycelium.
23 April.	Parasitized sporangia on radiating hyphae. (No control.)

There were several inoculation experiments made on the original host and one on *P. megasperma* which induced no parasitism. This may

have been due to the reduced vigour of the parasite or of its zoospores, or to the reduced vigour of the hosts. Inoculations were tried on *Rhipidium continuum* on tomatoes, and on *R. americanum* on ash twigs and no parasitism was obtained. As the parasite disappeared during the following vacation it was not possible to test its pathogenicity for *Pythium intermedium*, the host on which Butler found the similar parasite. Therefore it was not possible to determine whether the present species was identical with *Pleolpidium inflatum*.

Conclusions

It is clear that the present parasite is not very specialized, as it has been shown to attack two species of Pythiaceous fungi. It is therefore possible that it might also parasitize species of *Pythium*, and be identical with *Pleolpidium inflatum*. The points of difference noticed in comparing it with Butler's description are:

(1) *Host.* Apart from the fact that it was found only on *Pythium intermedium*, Butler also noted that only soil-inhabiting species of *Pythium* were attacked and that an aquatic species of *Pythium* bearing a parasite was never seen. The present parasite has so far been found only on aquatic species of *Phytophthora*.

(2) *Hypertrophy.* The excessive hypertrophy of supporting hyphae described as due to *Pleolpidium inflatum* was not found in the present form: only a few supporting hyphae were slightly swollen.

(3) *Size of sporangium.* The diameter of the largest sporangium noticed by Butler was 85μ. The largest I found was 74μ. This difference is not so important because the size of the sporangium is very variable in both, and slightly different conditions such as higher temperature (Butler worked at Antibes) might make much difference in the activity of both host and parasite.

(4) *Zoospores.* The zoospores of the parasite of *Pythium* tended to be reniform: those in the present cultures were pyriform.

Discussion

There is no doubt that the parasite here described is either identical with or closely related to *Pleolpidium inflatum* Butler. The genus *Pleolpidium* was established by Fischer (1892) for certain species of Cornu's genus *Rozella* (1872). Sparrow (1938) suggested that in the renaming of the genus by Fischer, the name *Rozella* should have been kept for the species now called *Pleolpidium*, because these were more typical of the genus as Cornu diagnosed it. *P. inflatum*, however, cannot now be included in this genus because the zoospores are biflagellate. The flagellation of the zoospore is considered to be an important diagnostic feature, and as the other species of *Pleolpidium*

have uniflagellate zoospores, *P. inflatum* should be separated from them.

In modern systems of classification (Gaümann, 1925; Fitzpatrick, 1930) all the related types with biflagellate zoospores are included in the family Woroninaceae. *P. inflatum* and the present parasite would most fittingly be placed in it. The family includes four genera viz. *Pseudolpidium*, *Olpidiopsis*, *Rozella* and *Woronina*. Their characteristic features are: (1) thallus plasmodial, mingling freely with the protoplasm of the host and not producing a mycelium; (2) parasitic and completely within the host; (3) sporangia multispored; (4) zoospores laterally biflagellate; (5) thick-walled resting spores in the host. The two fungi under consideration show all these features except (5). They differ from the members of the other genera in their sporangial formation. The sporangia are formed singly, and each completely fills the swollen hyphal tip of the host, and its wall is fused with that of the host and is indistinguishable from it. In the genera *Pseudolpidium* and *Olpidiopsis* the sporangia lie loosely in the host hyphae, and in the genera *Rozella* and *Woronina* the sporangia form a linear series separated by cross walls. If the sporangial form and fusion of walls constitute a generic difference, then a new genus must be erected to house the two species under consideration. The question remains whether this is advisable while the resting spores are still unknown.

If the parasite produces no resting spores it must continue its life either by reinoculation of the host, or by prolongation of the zoospore stage. The former seems to be more probable though more precarious. It was noticed in inoculation experiments that the vigorous hyphae were soon covered with swarms of attached zoospores. If, however, the host is as extensively parasitized in nature as it is in culture, being almost entirely transformed into parasitic sporangia, no such reinoculation would be possible. It is interesting to note here that in the inoculation experiments the introduction of the parasite seemed first to induce the production of normal host sporangia. This would ensure the provision of new young host plants for the subsequently produced zoospores of the parasite. Fischer (1882) observed instances of *Rozella* where a parasite did not interfere with the normal life of the host, normal sporangia and zoospores being produced, and it was only when secondary sporangia were forming that the parasite gained the upper hand. This seems to be a similar phenomenon though Fischer did not attach any significance to it.

If there is a prolongation of the zoospore stage it may be either as a zoospore or as a cyst. Many of the zoospores were seen to encyst; others continued their activity for twenty-four hours or more without abatement. Their subsequent history was not followed but it has often been observed that among bacterial colonies on bait from the river, there are small zoospore-like organisms strongly re-

sembling those of Chytrids. It is probable that water moulds both saprophytic and parasitic may be able to exist as unicells for considerable periods.

This account formed part of a thesis on the water moulds of the Hogsmill River submitted for the M.Sc. degree at the University of London, 1939. The work was carried out partly in the Royal Holloway College Botanical Laboratory, and my sincere thanks are due to Miss E. M. Blackwell, M.Sc., for facilitating this research and for her help and advice. I wish to thank Dr Ashby of the Imperial Mycological Institute for suggesting the affinities of the parasite, and to Sir Edwin Butler for his sympathetic interest and advice relating to the taxonomic position of this organism.

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HOST PLANTS OF THE BROWN ROT FUNGI IN BRITAIN

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(With Plates I and II)

In Europe, including the British Isles, the Brown Rot diseases of fruit trees are caused by two species of fungi, *Sclerotinia fructigena* Aderh. & Ruhl. (*Monilia fructigena* Pers.) and *Sclerotinia laxa* Aderh. & Ruhl. (*Monilia cinerea* Bon.).* The perfect (ascigerous) stage of these fungi is rarely found; that of *Sclerotinia fructigena* has not yet been recorded in Britain, while that of *S. laxa* has been found only once in this country (Wormald, 1921). It is thus a convenience to refer to these fungi by the names given to the imperfect (*Monilia*) stage, as it is this stage which is invariably found on infected trees. The *Sclerotinia* stage, on the few occasions when it occurred, developed on mummied fruit that had been lying on the ground for some months.

It has been usually assumed by continental workers that *Monilia fructigena* is almost confined to the pome fruits and *M. cinerea* to the stone fruits. In a recent paper by Mittmann (1938) this is again stated but with the reservation that the two species are not sharply specialized to those hosts. From observations in Britain it would be more rational, in distinguishing the two fungi by their mode of infection, to say that *M. cinerea* attacks the flowers of both pome and stone fruit trees and that *M. fructigena* is responsible for most of the Brown Rot of the fruit. It should be noted, however, that infection of the fruit of species of *Pyrus* by *M. cinerea* does occur but is rare; while on species of *Prunus*, although much of the fruit Brown Rot is caused by *M. cinerea*, the fungus most generally found, even on the common stone fruits (plum, cherry, peach) is *M. fructigena*. Blossom Wilt, so far as observations in Britain go, is invariably caused by *M. cinerea* both on the pome fruits and stone fruit trees.

Monilia cinerea on pome fruit trees

Blossom Wilt of apple trees, caused by *M. cinerea* forma *Mali*, is common and very destructive; it has been described in detail in former papers (Wormald, 1917). Blossom Wilt of pears is much less frequent, but it has been found in three localities (Wormald, 1930). The occurrence of *M. cinerea* on other species of *Pyrus* is described later in this paper.

* For a general account of these fungi see *Bulletin* no. 88 of the Ministry of Agriculture and Fisheries (Wormald, 1935).

Infection of the fruits of apple, pear and quince by *M. fructigena* is common and widespread and, by comparison, the corresponding damage by *M. cinerea* is rare. I have found *M. cinerea* on apples on three occasions only. It was seen on a single apple in the fruit shed at the Wye Agricultural College in 1920, and in 1922 two apples were found infected with this fungus. Since that time it has been found on a single apple at East Malling, but accompanied, on the same fruit, by *M. fructigena*. It has also been seen twice on small fruits (about 1 cm. long) of pear, in 1915 at Ash, in East Kent, and in 1921 on a specimen received from Exeter; numerous grey *Monilia* fructifications were present on both, and typical cultures of *M. cinerea* were obtained from the conidia.

It has been found once on quince; in 1925 a mummied flower was seen on a tree at East Malling with fructifications of *M. cinerea* on the flower and on its pedicel. In 1920 it was found on a mummied flower and on a withered leaf of medlar at Rodmersham, Kent.

Monilia fructigena on stone fruits

That *M. fructigena* is far from being confined to the pome fruits came to my notice some twenty years ago when, on a visit to a nursery in Sussex, I saw a number of plums infected with *M. fructigena* but none with *M. cinerea*. An examination of the plums in the fruit plantation at the Wye Agricultural College about that time also suggested that *M. fructigena* was quite as destructive to plums as *M. cinerea*, so fifty infected plums were taken at random and of these twenty-nine bore *M. fructigena*, thirteen had *M. cinerea* and on eight both fungi were present. On a Purple Egg plum tree seriously infected (about 15 % of the crop of that tree) 120 bore *M. fructigena*, 166 *M. cinerea* and forty-six had both; there was thus a slight preponderance of *M. cinerea* in this instance.

In more recent years observations at East Malling have shown that *M. fructigena* is generally more prevalent on stone fruits than *M. cinerea*. In 1926 *M. fructigena* was common on certain varieties on the Station. One St Julien plum tree in the "Museum Plot" bore a heavy crop of fruit, most of which were affected with Brown Rot. The fungus responsible for the rot was *M. fructigena* only; *M. cinerea* was not found on this tree. It was estimated that at least 90 % of the fruit was infected. One branch bore twenty-nine plums, and twenty-eight of these showed fructifications of *M. fructigena*; another branch had seventeen fruits, all infected (see Pl. II, fig. 6).

The preponderance of *M. fructigena* over *M. cinerea* on plums that year was seen in other instances. Of forty plums obtained from the packing shed (not specially selected, but fruit discarded by the packers as showing rot) thirty-seven bore *M. fructigena* only; the other

three bore both *M. fructigena* and *M. cinerea*. Again, on a tree of Magnum Bonum plum, eighteen showed Brown Rot of which sixteen bore *M. fructigena* and two *M. cinerea*. On a number of Cherry Plum and Morello cherry trees at Maidstone Brown Rot of the fruit was caused by *M. fructigena* only.

In 1927 also, Brown Rot of stone fruit at East Malling was caused almost solely by *M. fructigena*. In July, Morello cherries (fruit) on a trial plot at East Malling were infected with *M. fructigena* only; on two Morello trees in a Maidstone garden *M. cinerea* was found on one fruit only; all others with Brown Rot bore *M. fructigena*. During the same month Mr N. H. Grubb informed me that fully 50 % of the fruit on a St Julien plum tree in his garden was infected with Brown Rot caused by *M. fructigena*. Other plums of various varieties were examined with the result that, out of 234 with Brown Rot, 226 were found to be infected with *M. fructigena*, six with *M. cinerea* and two with both. On Black Bullace trees 254 fruits were infected and all bore *M. fructigena*.

The fruit of the varieties of plum included under *Prunus insititia* appears to be very susceptible to infection by *M. fructigena*. Severe infection of St Julien plums and Black Bullace is mentioned above. On damsons no special observations have been made in the field though both the Brown Rot fungi are known to infect the ripening fruit. On damsons in cold store, counts have been made and again both fungi were found to be responsible for considerable wastage, with, on the whole, *M. fructigena* predominating (Wormald & Painter, 1935, 1937). In 1939, clusters of infected fruits (up to twelve in a cluster) were seen on a tree of Shepherd's Bullace on the Station; more than seventy infected fruits were counted and only four of these bore *M. cinerea*; the rest were infected with *M. fructigena*. Two other trees of the same variety had fewer infected fruits, about twenty in all, but all bore *M. fructigena*.

On Morello cherries *M. fructigena* is the fungus usually associated with rotting of the ripening fruit; sometimes the infection is accompanied by an exudation of gum at the base of the stalk of an infected fruit, indicating that the fungus had first attacked the fruit and then extended within the stalk into the twig bearing it to produce a lesion.

On the fruit of peach and nectarine trees both species of *Monilia* occur, but no estimate of their relative importance in this connexion has been made, although on one occasion *M. fructigena* was noted as the only fungus causing Brown Rot of the fruit of a few trees growing under glass.

The observations recorded above show that *M. fructigena* causes quite as much rot of stone fruit as *M. cinerea* and often it is the species most generally found.

The Brown Rot fungi on other host plants

It may not be generally known that in Britain the Brown Rot fungi attack plants other than the commonly cultivated fruit trees. Many species of the genera *Pyrus* and *Prunus* are grown in this country as ornamental shrubs, and some of these have been found to be susceptible to Brown Rot infection. Possibly others are equally susceptible but have not yet become infected from other host plants, or they may have been infected and the damage not recognized as caused by a Brown Rot fungus, for the fungi do not always produce fructifications on the parts infected. The infection of ornamental shrubs is mostly by *M. cinerea*, which enters by the flowers, producing Blossom Wilt, and then grows into the twigs; if these are girdled by the resulting lesions the parts terminal to the lesions wilt. When this occurs on the young twigs, as so often happens, the condition is sometimes referred to as Twig Blight. The following instances of Brown Rot infection of ornamental shrubs have come to my notice.

Prunus serrulata Lindl.* (a Japanese Flowering Cherry). In 1925 a large tree of this Japanese ornamental cherry in a garden at Benenden, Kent, had many of the tips of the branches killed and there were definite lesions on them. The areas where the lesions occurred had borne flowers and it was inferred that infection had entered through the flowers. No fungal fructifications were seen, but *M. cinerea* was isolated in culture from the tissues of the lesions.

Similar dying-back of the branches was seen the following year and again *M. cinerea* was isolated from the lesions on the dead twigs.

Prunus tomentosa Thunb. (a Chinese Flowering Cherry). This species of flowering cherry appears to be very susceptible to Blossom Wilt and the subsequent death of the young twigs. The dead twigs give rise to grey *Monilia* fructifications the following spring.

In 1929 specimens were received from Meopham, Kent, taken from a tree severely infected. Many of the tips of the branches were withering for a length of three to twenty inches (Pl. I, fig. 4). There were also dead leafless twigs bearing pustules of *M. cinerea*; these had evidently been infected the previous year.

The flowers when first examined bore no fructifications, but on keeping wilted twigs in a moist chamber for twenty-four hours some of the dead flowers bore tufts of conidial chains of *M. cinerea*.

In 1931 dead twigs bearing withered flowers were found on bushes on the Research Station and in a private garden at East Malling. No conidial fructifications were seen, even after specimens were kept in a moist chamber for several days, but *M. cinerea* was easily isolated from such material by plating out small pieces of the infected bark.

* There are several varieties of *Prunus serrulata* in cultivation. The particular variety affected was not ascertained.

In 1939 Twig Blight, as a result of blossom infection, again appeared on the same host in a garden at East Malling. As before, no fructifications were present on the specimens examined but the fungus was isolated in culture from tissues of the twig lesions; later this strain from *Prunus tomentosus* was inoculated into Morello cherries, and fructifications of *M. cinerea* developed within three days.

Prunus pumila L. (Sand Cherry or Dwarf American Cherry). This species also is very susceptible to blossom infection with subsequent death of branches bearing infected flowers.

In 1924 a young tree in the "Museum Plot" at East Malling, had all the branches bearing flowers killed back apparently by infection through the flowers, for those branches not bearing flowers were unaffected. No fungus fructifications were seen on the flowers, but *M. cinerea* was isolated from the bark of a lesion on one of the branches.

Prunus Padus L. (Bird Cherry). In July 1931 and 1932 trees on the East Malling Research Station showed withered twigs and dead flowers (Pl. I, fig. 5). No fungus fructifications were seen but on keeping specimens in a moist chamber for three days fructifications of *M. cinerea* appeared. The fungus was isolated from the conidia so obtained and also from the tissues of dead twigs after surface sterilization. The cultures produced growth typical of *M. cinerea*.

Infection apparently occurred through the flowers. Only some of the flowers on certain inflorescences were killed; in others, however, infection extended into the axis of the inflorescence so that all the flowers withered, and sometimes into the twig bearing the inflorescence, thus killing the terminal portion of the twig.

Prunus Amygdalus Stokes (Almond). *M. fructigena* infects the fruits, and sometimes clusters of the mummified fruits are conspicuous in autumn after leaf-fall. In 1934, specimens showing this condition were received from Croydon, and it has been seen in other localities. Possibly the flowers become infected but there appears to be no record of Blossom Wilt of the common almond in Britain.

Prunus nana Stokes (Dwarf Russian Almond). A dead twig from a bush of Dwarf Russian Almond was received from Horsted Keynes, Sussex, in June 1932. *M. cinerea* was isolated from the discoloured bark. Infection had probably arisen through the flowers.

Pyrus purpurea Hort. (a Flowering Crab). Blossom Wilt of this handsome flowering crab was seen on specimens received from Seddlescombe, Sussex, in 1935.* On the recently killed inflorescences were grey *Monilia* fructifications; they were found on the flower stalks, the calyx, and the filaments of the stamens. The specimens included portions of old spurs, killed by infection during the previous year, and these also bore grey *Monilia* fructifications.

* Specimens kindly sent by Mr G. C. Johnson, Horticultural Superintendent, East Sussex.

The conidia on the old spurs measured $10–16 \times 8–10\mu$; those on the flower stalks of the recently killed flowers were larger, measuring $14–22 \times 12–16\mu$. This discrepancy in the size of the conidia produced on the old dead wood and on the recently infected flowers has been observed on other host plants infected with *M. cinerea*.

Cultures prepared from (*a*) conidia from an old spur, (*b*) conidia from a flower stalk of flower infected that year, and (*c*) the tissues of the axis of a young infected spur, all gave rise to cultures typical of *M. cinerea*.

The same year a similar Blossom Wilt of the same host was seen in a garden at East Malling. In 1937, specimens received from Lyndhurst, Hampshire, showed what was apparently Blossom Wilt; no *Monilia* fructifications were present but *M. cinerea* was isolated in culture from the tissues of one of the twigs, and inoculations of the strain isolated into plums produced a rapid rot, and fructifications of *M. cinerea* appeared.

In 1935, the fruit of this crab was infected with *M. fructigena* on trees at Reading (Berkshire) and at East Malling.

Pyrus elaeagnifolia Pall. (a Wild Pear from Asia Minor). Typical Blossom Wilt and canker was seen in 1925 on a Caucasian Pear Tree growing on the East Malling Research Station. The end of a branch was dead for a length of seven inches; at the lower end of this portion there was a girdling canker two inches long with a dead spur near the middle; one flower of the spur bore pustules of *M. cinerea* so that it was assumed that infection had started at this flower, and that the fungus extended into the spur and then into the branch to cause the canker.

Pyrus Aria Ehrh. (White Beam). In June 1924 infection of flowers was seen on a White Beam tree in the "Museum Plot" at East Malling Research Station. The infected inflorescences were not wholly destroyed but portions were killed and grey *Monilia* fructifications were present on some of the flowers and pedicels (Pl. I, fig. 1). The morphological and cultural characters of the fungus corresponded to those of *M. cinerea*.

Pyrus japonica Thunb. (Japanese Quince). In a garden at Maidstone, in June 1917, a Japanese Quince, growing on the side of the house, was seen to have wilted clusters of flowers with cankers round the base of some of the dead inflorescences (Pl. I, fig. 2). Grey *Monilia* fructifications were present on some of the wilting flowers. The dimensions of the conidia and the habit of the cultures isolated from conidia were those of *M. cinerea*.

A bush of "Japonica" in an East Malling garden showed severe Blossom Wilt and Twig Blight in June 1939. No *Monilia* fructifications were seen on the flowers but culture plates prepared from the tissues of the lesions on twigs gave growth typical of *M. cinerea*, and inoculations into green Morello cherries (fruit) produced a rapid rot, and fructifications of *M. cinerea* appeared within three days.

Cross-inoculations

It is important to realize that probably all the host plants mentioned, fruit trees and ornamental bushes alike, serve as sources of infection for the others, for there is little evidence that biologic forms occur in the Brown Rot fungi. During the course of this investigation considerable variation in cultural characters has been observed in the strains isolated of both fungi, even among strains from one species of host. Pesante (1935, 1937) has observed similar variation in cultures of the Brown Rot fungi in Italy and refers to biologic forms or races on those grounds. Such cultural forms are known to exist in many species of fungi and they bear little or no relation to specialization of parasitism within the species.

The Blossom Wilt of the apple in Britain is caused by a form of *M. cinerea* biologically distinct from that of the stone fruit trees since strains from the latter failed to produce typical Blossom Wilt of apple in inoculation experiments (Wormald, 1917); these results were confirmed by Boyle *et al.* (1928) in Ireland, though Christoff (1938) finds no such distinction in Bulgaria. In other cross inoculations, described below, successful infection has been obtained. Mittmann (1938) also describes success in a number of cross inoculations on various hosts, with isolations of both *M. fructigena* and *M. cinerea.*

I have carried out a number of such cross inoculations from time to time and a summary of the results is here given.

Monilia fructigena

(1) Quince to apple. Apples inoculated with a pure culture from quince became brown, then black (the condition known as Black Apple).

(2) Apple to plum. Conidia taken direct from an apple were inoculated into plums (var. Shepherd's Bullace) which rapidly became infected and produced fructifications of *M. fructigena* within three to four days.

(3) Plum to apple and pear. Inoculations were made with conidia taken direct from a plum. Rapid rot set in and within seven days the whole surface was brown and bore numerous fructifications of *M. fructigena.*

Monilia cinerea

(1) Pear (spur) to apple (flowers). Typical Blossom Wilt resulted but only in one inflorescence out of six; the experiment has not been repeated.

(2) Pear (spur) to plum (fruit). Inoculations on trees in the open produced rapid fruit rot, and fructifications of *M. cinerea* appeared within five days.

(3) Medlar (leaf) to apple (flowers). Typical Blossom Wilt.

(4) Plum (twig) to pear (flowers). Typical Blossom Wilt.
(5) Plum (fruit) to Morello (flowers). Typical Blossom Wilt.
(6) Cherry (fruit) to Morello (flowers). Typical Blossom Wilt.
(7) Cherry (fruit) to pear (flowers). Typical Blossom Wilt.
(8) Apricot (twig) to cherry (fruit). Rapid rot of fruit inoculated, and the rot then extended to others of same cluster.
(9) Apricot (twig) to cherry (flowers). Inoculated flowers wilted (Fig. 9).
(10) *Prunus tomentosa* (twig) to apple (fruit). Rapid rot with appearance of fructification of *M. cinerea* within four days.
(11) *Prunus tomentosa* (twig) to pear (fruit). Ditto.
(12) *Prunus tomentosa* (twig) to Morello (fruit). Ditto.
(13) *Pyrus japonica* (twig) to apple (fruit). Ditto.
(14) *Pyrus japonica* (twig) to pear (fruit). Ditto.
(15) *Pyrus japonica* (twig) to Morello (fruit). Ditto.
(16) *Pyrus purpurea* (twig) to plum (fruit). Rapid rot with fructifications within seven days.

Corresponding inoculations with isolations from fruit trees have not been made on flowering shrubs. Until such experiments have been carried out it is to be assumed however (in view of the ready infection of fruits, using isolations from three ornamental shrubs), that fruits bearing *M. cinerea* are a potential source of infection for the flowers of those species of *Pyrus* and *Prunus* that are cultivated in gardens for their beauty.

In efforts to reduce the severe losses resulting from infection by the Brown Rot fungi all possible sources of infection should be borne in mind, and hygienic measures by the removal and burning of all infected parts should be practised whenever possible. Such measures have frequently been emphasized with reference to fruit trees, but it must be recognized that ornamental trees too may become infected and the necessary steps should be taken to keep these also free from Brown Rot diseases, especially when, as in nurseries, ornamental bushes and fruit trees are grown in close proximity.

Summary

Of the two Brown Rot fungi found in Britain *Sclerotinia laxa* (*Monilia cinerea*) is the cause of Blossom Wilt of fruit trees and ornamental shrubs of species of *Pyrus* and *Prunus*, while *Sclerotinia fructigena* (*Monilia fructigena*) is the fungus most frequently found associated with fruit Brown Rot.

Observations of the occurrence of *M. cinerea* on core fruits, and of *M. fructigena* on stone fruits are described

The fungi have been found on a number of species of ornamental shrubs.

Cross-inoculations with the fungi from various hosts have yielded positive results on a number of other hosts.

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EXPLANATION OF PLATES I AND II

PLATE I

Fig. 1. Inflorescence of White Beam with about half the flowers infected with *Monilia cinerea*.

Fig. 2. Infected flowers of *Pyrus japonica*.

Fig. 3. Blossom infection of *Pyrus purpurea* with accompanying Twig Blight.

Fig. 4. Twig Blight of *Prunus tomentosa*.

Fig. 5. Twig Blight of *Prunus Padus*.

PLATE II

Fig. 6. St Julien plums with *Monilia fructigena*.

Fig. 7. Blossom Wilt and Twig Blight of Morello Cherry after inoculation of the flowers with *Monilia cinerea* from plum.

Fig. 8. One cherry was inoculated with *M. cinerea* from apricot, and the rot is extending to others in contact with it.

Fig. 9. On the left below are two wilting flowers that were inoculated with *M. cinerea* from apricot.

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Fig 5

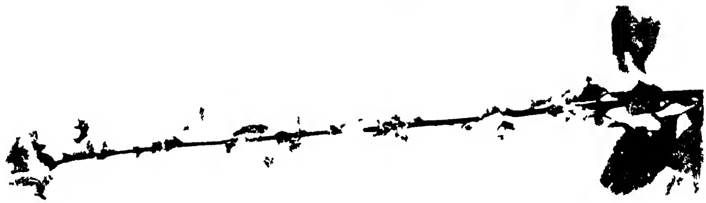

Fig 4

Fig 3

Fig 1

NOTE ON THE DISTRIBUTION OF BASIDIA IN FRUIT BODIES OF *NYCTALIS PARASITICA* (BULL.) FR.

By C. T. INGOLD

(With 3 Text-figures)

Nyctalis parasitica, one of the few agarics parasitic on other agarics, is of special interest because the fruit body sometimes bears two kinds of spores, chlamydospores, formed within the tissue of the gill, and basidiospores.

Most of the details of the life history of the fungus were made clear by Brefeld (1884) who succeeded in germinating both basidiospores and chlamydospores.

De Bary (1859) investigating *N. parasitica* never found basidia in any of the fruit bodies which he examined. Brefeld (1884) found occasional basidia in some fruit bodies. Buller (1924), who gives a full history of the work of other investigators on *N. parasitica*, adds his own observation that fruit bodies examined by him were sterile. He concludes that basidia production in this fungus must be regarded as very exceptional. Recently Thompson (1936) in America has grown the fungus saprophytically in pure culture. He made a careful examination both of fruit bodies occurring in nature and those produced in culture, but he failed to find basidia.

In Swithland Wood, six miles north of Leicester, I have found *N. parasitica* growing abundantly as a parasite on *Lactarius vellereus*. In the part of the wood where *L. vellereus* was common most of the fruit bodies had a crop of *Nyctalis parasitica*. A large number of the fruit bodies of the parasite were examined in August 1938, and nearly all these bore basidia. Observations were again made a year later, when every fruit body examined (over fifty) was fertile. The fruit bodies varied from small ones with a cap less than 1 cm. in diameter up to large ones, 2·5 cm. across. From the fruit bodies normal basidiospore-prints were obtained, which, however, were much fainter than is usual with white-spored agarics of similar size. Nevertheless, a spore print clearly visible to the unaided eye was usually obtained after a pileus had been inverted over a glass plate for four hours. The spores in these prints, when examined in water, agreed in size with the measurements given by Rea (1922).

Sections of the pileus, cut vertically and more or less tangentially, showed the gills covered with a layer homologous with the normal

hymenium of Hymenomycetes. Most of this layer, however, was sterile. This "sterile hymenium" differed from the normal hymenium not merely in the absence of basidia It consisted of filamentous elements nearly twice as long as the paraphyses of the fertile hymenium, and these elements were fairly loosely arranged, not closely pressed

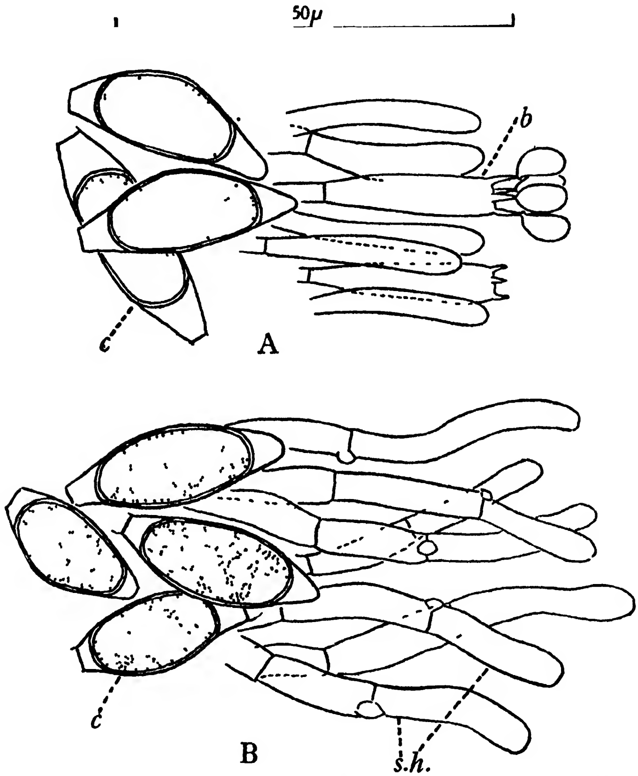

Fig 1 *Nyctalis parasitica* Details of fertile hymenium (A) and "sterile hymenium" (B) *b*, basidium, *c*, chlamydospore, *s h* hyphae of "sterile hymenium".

together, as in a palisade, like the elements of the true hymenium (Fig. 1 B). The fertile hymenium was very much like that of any normal toadstool (Fig. 1 A). Below both kinds of hymenium the tissue of the gill was largely composed of a mass of chlamydospores.

The distribution of sterile and fertile hymenia on the gills followed a definite plan. True hymenium with basidia occupied the free edge

of each gill and usually extended from this edge on to the lateral surfaces of the gill (Fig. 2), but it soon gave place to "sterile hymenium". The boundaries between the two kinds of hymenium were nearly always quite sharp. Frequently the fertile hymenium was entirely limited to the free edge of the gill and did not extend on to the vertical gill surfaces. Occasionally in a sporophore a few of the smaller, shallower gills were found to have no true hymenium.

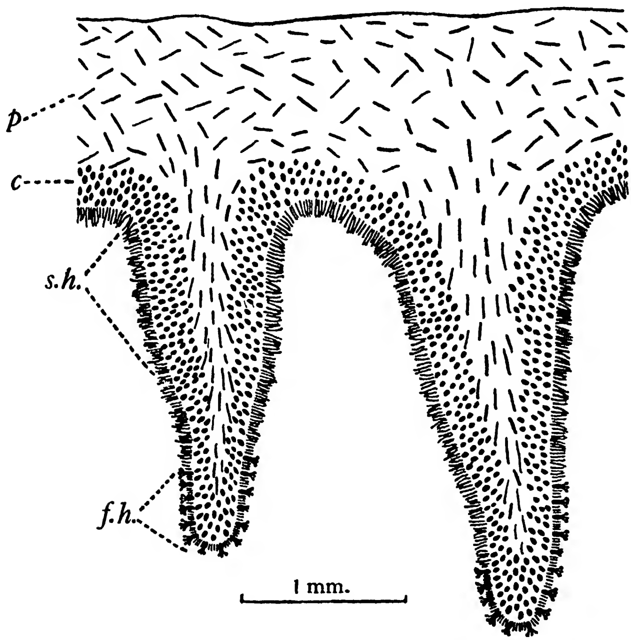

Fig. 2. *Nyctalis parasitica.* Diagram showing the distribution of tissues in a vertical tangential section of the pileus. Outlines of the tissues drawn with the aid of a *camera lucida*. *c*, zone of chlamydospores; *p*, pileus tissue; *f.h.* fertile hymenium; *s.h.* "sterile hymenium".

When a gill was removed from a fruit body and examined in surface view by reflected light under the low power of the microscope, the distinction between true hymenium and "sterile hymenium" was very clear. The "sterile hymenium" had a whitish fleecy appearance, while the true hymenium was greyish with a translucent and almost water-soaked appearance (Fig. 3).

In *N. asterophora*, the only other British species of *Nyctalis*, the chlamydospores are produced, not in the tissue of the gill as in *N. parasitica*, but in the tissue of the upper region of the pileus. The

stellate chlamydospores finally form on the cap a dry powder which can be blown away by the wind. In the specimens of *N. parasitica* which I have examined, the gills, with the smooth chlamydospores immersed in the subhymenial tissues, never break down to a dry

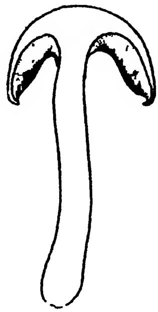

Fig. 3. *Nyctalis parasitica*. Longitudinal section of a fruit body showing two gills. On each the "sterile hymenium" is stippled and the fertile hymenium is shown by vertical shading, ×2.

powder, and probably can be liberated only when the fruit body decays.

It would be interesting to know whether *Nyctalis parasitica* in this country is usually sterile, or whether the kind of fruit body which gives a spore print is common.

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TUBERCULARIA

By T. PETCH

THE genus *Tubercularia*, as accepted at present, was established by Tode (1790) with the species, *T. vulgaris*, *T fasciculata*, *T. volvata* and *T. sulcata*. He divided *T. vulgaris* into two forms, *subsessilis* and *stipitata*, but withdrew that in 1791 as superfluous. Of the other species, *T. volvata* and *T. sulcata* were referred to *Ditiola* by Fries (1823), while Persoon (1822) placed *T. fasciculata* as a variety of *Peziza carpinea*, but said it seemed to be a distinct species (of *Peziza*).

Persoon (1796) added another species, *T. discoidea*, and in 1801 he included in the genus, *T. discoidea* Pers., *T. vulgaris* Tode, *T. granulata* Pers., *T. confluens* Pers., and *T. Castaneae* Pers. In 1803, Schumacher described nine new species, *T. Artemisiae*, *T. Pini*, *T. minuta*, *T. Pruni*, *T. Cerasi*, *T. Populi*, *T. sulcata*, *T. nigra* and *T. hirsuta*. Link (1825) stated that it was not possible to determine Schumacher's species because his collection had been destroyed in the siege of Copenhagen in 1807, but, following Fries (1832 and Index), it is usual to regard *T. Artemisiae* as *T. vulgaris*, and *T. Cerasi*, *T. nigra*, *T. Pini*, *T. sulcata* and *T. hirsuta* as not *Tubercularia*. *T. Pruni* and *T. Populi* are given by Saccardo (1886) as synonyms of *T. vulgaris*.

Albertini & Schweinitz (1805) described a new species, *T. ciliata*, and two others, *T. saligna* and *T. bicolor*, about which they had some doubt. *T. ciliata* A. & S. is now *Volutella ciliata*. Link (1825) discarded the other two with the remark that their authors themselves regarded them as doubtful species, but Wallroth (1833) renamed *T. saligna*, *T. granulata* var. *Salicis*. Fries (1815) described five new species as *T. Acaciae*, *T. sarmentorum*, *T. Menispermi*, *T. herbarum* and *T. liceoides*, and in the following year, Link (1816) added *T. ciliata* Link and *T. floccosa* Link. The latter species had been sent him by Nees, who himself published it (1817) as *T. velutipes*. Similarly, *T. ciliata* Link is the same as *T. ciliata* Ditm. (1817).

The genus had expanded at a rapid rate, usually by the addition of new species based on differences of host; and in 1825, Link made the first attempt to reduce it to order. He enumerated the following species, with their synonyms.

T. vulgaris Tode. *T. lutescens* Link. *T. minor* Link; syn. *T. Acaciae* Fr., *T. Castaniae* Pers., *T. confluens* Pers., *T. discoidea* Pers., *T. mutabilis* Nees. *T. granulata* Pers.; syn. *T. Pseud-acaciae* Rebent. *T. dubia* Link, a re-naming of the American species, *T. nigrescens* Schwein. *T. floccosa* Link; syn. *T. velutipes* Nees, *T. nigricans* Link, Bulliard, pl. 455,

fig. 1. *T. ciliata* Ditm., *T. liceoides* Fr., *T. herbarum* Fr.; syn. *T. Artemisiae* Schum., *T. Menispermi* Fr.

In *Systema Mycologicum*, Fries (1832) included *T. vulgaris* Tode, *T. ciliata* Ditm., *T. herbarum* Fr., *T. granulata* Pers. and *T. nigricans* Link, with *T. liceoides* Fr. as a state of *T. granulata*, but referred his readers to Link (1825) for the remaining species, thus providing numerous problems for nomenclature which begins with Fries, *Systema*. He did, however, mention *T. minor* Link in his observations on the genus; and in the Index he gave *T. Acaciae* Fr., *T. Castaneae* Pers., and *T. discoidea* Pers., as synonyms of *T. minor*, and *T. Artemisiae* Schum. and *T. confluens* Pers., as synonyms of *T. vulgaris*. In addition, the Index includes a number of species which had been described as *Tubercularia* but had been transferred to other genera and need not be detailed here.

Wallroth (1833) made another attempt to clarify what he styled "*genus vexatum*", principally by reducing species to varieties. He enumerated four species, *T. vulgaris* with seven varieties, *T. granulata* with eight varieties, *T. liceoides* Fr. and *T. ciliata* Ditm. Apparently his work was written before the completion of Fries, *Systema*, as it does not take into account Fries's withdrawal of *T. liceoides*. His varieties are based principally on host differences, and he appears to have drawn his conclusions from the host records.

Corda (1829) described and figured *T. floccipes*. Subsequently he dealt extensively with the genus, describing and figuring *T. carneola* Cda., *T. carpogena* Cda., *T. rufa* Cda., *T. effusa* Cda., *T. fusisporum* Cda., *T. pinophila* Cda., *T. Sambuci* Cda., *T. herbarum* Fr., *T. liceoides* Fr., *T. minor* Link var. *rosea*, *T. mutabilis* Nees, *T. confluens* Pers., *T. granulata* Pers., *T. hysterina* Cda., *T. Aesculi* Opiz, *T. vulgaris* Tode, *T. vulgaris* var. *Rubi* Rabh., *T. vaginata* Cda., and *T. carnea* (Cda.) Sacc., in 1837; *T. purpurata* (Cda.) Sacc., *T. granulata* var. *cava* Cda., and *T. volutella* Cda., in 1838; and *T. Pinastri* Libert in 1839.

Fries (1849) enumerated for Scandinavia, *T. vulgaris* Tode, with *T. discoidea* Pers., as a variety, *T. confluens* Pers., *T. corrugata* Fr. (*nomen nudum*), *T. granulata* Pers., *T. liceoides* Fr., *T. mutabilis* Nees, *T. expallens* Fr. (*nomen nudum*), *T. ciliata* Ditm., *T. sarmentorum* f. *Rubi*, *T. Pinastri* Libert and *T. herbarum* Fr. It will be noted that Fries revived *T. liceoides* as distinct from *T. granulata*.

Tulasne (1865) stated that he considered as more or less aberrant forms of *T. vulgaris*, but not as distinct species, *T. nigricans*, *T. discoidea*, *T. granulata*, *T. confluens*, *T. Castaneae*, *T. Menispermi*, *T. sarmentorum*, *T. minor*, *T. mutabilis* and *T. expallens*—a view with which Saccardo (1886) said he willingly agreed.

In the first half of the last century, species of *Tubercularia* had been founded on macroscopic characters and host differences; and as the European species are variable and not restricted to a single host, it

is to be expected that most of the earlier names relate to two or three species only. The first attempt to differentiate between them on microscopic data was made by Paoletti (1887), who examined 126 specimens, supposed to include twenty-six species and several forms, in the herbarium of Prof. P. A. Saccardo, most of which had been issued in well-known European exsiccata. These he reduced to ten species, three of which were new.

Paoletti first separated those species in which the conidia are borne only on the apex of the conidiophore; in this group he had only two species, *T. versicolor* Sacc. and *T. Libertiana* Paol., which really are not co-generic with *T. vulgaris*. To divide the remaining mass, he took the length of the stalk, the colour of the stroma, and the branching of the conidiophore.

As regards the stalk, it will be evident to anyone who collects *T. vulgaris* or *T. minor* in quantity that this character is variable. In some sporodochia the stalk is short and almost completely immersed in the host, so that the sporodochium appears sessile, but in other specimens in the same gathering, the stalk may be much longer and emergent, so that the sporodochium is distinctly stalked.

Paoletti did not record how he judged the colour of the stroma, as distinct from the colour of the spore-mass, whether the colour of the head after removal of the conidia, or the external colour, or the internal colour as seen in section. All these may change with age, and their appearance in herbarium specimens may depend on the stage of development of the sporodochium when collected.

In *T. vulgaris*, the conidia are borne apically on the conidiophore and on short lateral branches. Paoletti found that, in some of the alleged species which he examined, the lateral branches were short, not exceeding the conidium in length, while in others some branches of some conidiophores were longer than the conidia and sometimes again branched. Accordingly he adopted that as a specific difference, and based the ultimate separation of his species on whether they had all the branches of the conidiophores equal to or shorter than the conidium, as in *T. vulgaris*, or whether *some* conidiophores had one or more branches longer than the conidium, as in *T. minor*. When I began this investigation, that criterion appeared to me to be valid, but as more specimens were examined, it became evident that it was unreliable. In sporodochia referable to *T. minor*, conidiophores with long branches are common; in those referable to *T. vulgaris* they are not obvious, but can generally be found by careful searching. Moreover, conidiophores with branches longer than the conidium can often be found in sporodochia which, from the development of *Nectria cinnabarina* on the same or adjacent stromata, can only be regarded as *T. vulgaris*, while the perithecia which occur on stromata which have all the characters of *T. minor* are those of *N. cinnabarina*.

Consequently, it is not possible to separate *T. minor* from *T. vulgaris* on the length of the stalk, the colour of the stroma, the presence of conidiophores with long branches, or a difference in the perithecial stage. I have therefore been compelled to agree with Tulasne and Saccardo that *T. minor* is only a form of *T. vulgaris*. It probably owes its morphological differences, which are differences of degree only, to its looser structure, though I am unable to offer any explanation of its peculiar internal colour changes, which will be mentioned later.

Cultures have been attempted only on oatmeal agar. No difference was observed between the growth of *T. vulgaris* and that of *T. minor* on that medium. The cultures produced white, tomentose, pulvinate or subcylindrical stromata, but no conidiophores or conidia.

This work was undertaken with the object of identifying the commoner British species of *Tubercularia*. Attention has therefore been confined to species which have been recorded for this country, and to European species which might be expected to occur here. North American and tropical species have not been examined, and no attempt has been made to deal with the whole mass of material of this genus, over 500 collections, in the herbaria of Kew and the British Museum.

Tubercularia vulgaris Tode

In the typical form, the sporodochium consists of a pulvinate head, even or tuberculate, and a short stalk. Usually the stalk is almost completely immersed in the host, and the head is concave beneath, its margin resting on the host, so that the sporodochium appears sessile. Forms which are evidently stalked, i.e. with a projecting stalk which raises the head above the surface of the host, also occur, but frequently the stalk in such examples is sheathed for part of its length by the upturned periderm of the host, so that this variation may depend upon the structure of the host. I have observed such a stalked form on birch twigs, and Paoletti described and figured it as *T. Rhamni* on *Rhamnus*.

The appearance of the head varies with the state of development of the fungus. At first it is red and subtranslucent, and appears horny when dry, but when masses of conidia have developed it is pinkish and opaque when dry. The stalk is red or brownish red externally, sometimes becoming fuscous. Internally the layer of conidiophores and conidia is at first red and subtranslucent, but on drying it becomes deep pink, with a narrow translucent zone often persisting for some time at the base. The stroma is pale yellow or ochraceous internally when dry. I use the term stroma for all the tissue below the layer of conidiophores (including the stalk), which is apparently what Paoletti intended by that term.

The stroma is parenchymatous, composed, in the interior, of cuboid or rectangular cells, from $9 \times 6\mu$ to $27 \times 9\mu$, with hyaline walls about 2μ thick. Sometimes isolated files of rectangular cells occur, but in general the tissue is irregularly parenchymatous. The outer tissue of the stroma is composed of small cells only, about 4–6μ diameter, usually with red walls, and often in files which curve outwards. A short distance below the zone of conidiophores, the irregularly parenchymatous tissue may give rise to parallel, laterally adherent files of thin-walled rectangular cells, 2–4μ broad. The conidiophores are borne on the uppermost cells of the stroma, one, or two, from each cell.

The conidiophores are usually strongly curved, 1·5–2μ diameter, and bear solitary conidia apically on the main conidiophore and on short lateral branches. The lateral branches are sometimes so short that the conidia appear almost sessile, but conidiophores with long lateral branches may be found, especially near the margin of the sporodochium. The conidia are hyaline, mostly cylindrical, usually curved, with some narrow oval, generally 5–9×2–$2{\cdot}5\mu$, sometimes up to 11μ long.

Paoletti (1887) gave *T. Ribesii* West., *T. Populii* Schum., *T. Pruni* Schum., and *T. Robiniae* Kickx, as synonyms of *T. vulgaris*, and found that the type collections of *T. Berberidis* Thüm., and *T. Ailanthi* Cke., were also that species.

T. lutescens Link was said by Fries (1832*a*) to occur with *Nectria ochracea* Grev. & Fr. As the latter is a yellow form of *N. cinnabarina*, it is most probable that *T. lutescens* is *T. vulgaris*.

T. sarmentorum and *T. Menispermi* were described by Fries at the same time (1815), but later (Index) he withdrew the latter name as a synonym of the former. Fries issued specimens of *T. sarmentorum* on *Menispermum* in *Sclerom. Suec.* no. 259, and Link, after examination of one of these, stated that it did not bear a stratum of conidia, and suggested that it was an imperfect *Fusarium roseum*. Wallroth (1833) placed *T. sarmentorum* as a variety of *T. vulgaris*, and added to the description the phrase, emerging in lines longitudinally through fissures in the bark, a character which, as pointed out by Paoletti, depends upon the host rather than upon the fungus. Fries, *Sclerom. Suec.* no. 259, is *T. vulgaris*. Link's observation was probably due to the fact that some of the sporodochia in Fries's specimens have been eaten off down to the bases of the conidiophores. Thumen's specimens on *Vitis* in *Mycoth. Univ.* no. 1196 and *Pilze Weinst.* no. 24, and Rabh. *Fung. Europ.* no. 585 on *Koelreuteria paniculata* are *T. vulgaris*. Paoletti took as *T. sarmentorum* a specimen on *Begonia* twigs collected by Saccardo in Italy, a stalked specimen with an expanded base, but from his description and figures it does not differ from *T. vulgaris*. *T. sarmentorum* must be regarded, from the specimens on *Menispermum*

issued by Fries, as a synonym of *T. vulgaris*, though the first host mentioned in his description of the species is *Vitis*.

T. Rhamni Paoletti is a stalked specimen of *T. vulgaris*, from his description and from the specimen, Roum., *Fung. Sel. Gall. Exsicc.* no. 273, cited by him. *T. Rhamni* Paol., on *Rhamnus frangula* in Petrak, *Fung. Alban. et Bosn. Exsicc.* no. 161, is *T. vulgaris*.

British specimens of *T. Sambuci* Cda., and *T. Aesculi* Opiz are *T. vulgaris*.

T. aquifolia Cke. & Massee, on leaves of holly, is *T. vulgaris*. The sporodochia in the type specimen are small, with conidia, $5-8 \times 2-2{\cdot}5\,\mu$. The conidiophores have been eaten off (in part), leaving lengths of about $20\,\mu$, arising two or three together from a basal cell. That explains Cooke and Massee's statement that the conidiophores are rather thick and furcate, while their spore measurement, $12-15 \times 2-3\,\mu$, probably refers to the length of the conidiophore remaining. Where normal conidiophores are present, they are those of *T. vulgaris*.

T. conorum Massee, type in Herb. Kew., is *T. vulgaris*, with conidiophores straighter than usual.

T. Berberidis Thüm., is discussed under *T. granulata*.

Form *minor* was described as *T. minor* by Link (1825), who stated that it was smaller than *T. vulgaris*, immersed, red or white, with a very red, smooth and diffluent stratum of conidia; if the spore masses spread so that several individuals were united, it became *T. confluens*; while when effete, the conidia having entirely or partly slipped off, it became *T. discoidea*. Persoon (1801) described *T. discoidea* as hemispherico-discoid, and added that some specimens were confluent, and the head was smooth, not sulcate, the conidia being easily washed away by the rain, so that a dingy white, naked stroma remained; and *T. confluens* as gregarious, confluent, pinkish red, small, rather flat, subcircular, oblong or angular. Link gave as synonyms, *T. Castaneae* Pers., and *T. Acaciae* Fr., a view which Fries (Index) accepted. There seems no doubt that Link was right as regards *T. discoidea* and *T. confluens*, but his choice of the name *minor* was not a happy one, as this form varies in size as much as the normal form of *T. vulgaris*. The epithet *discoidea* appears from the herbarium specimens to have been applied subsequently to flat, circular sporodochia, slightly depressed in the centre, part of the spore mass having disappeared.

The sporodochia may be stalked or "sessile", the latter having the stalk almost totally immersed in the host, but when well-developed they are distinctly stalked. On *Brassica*, the stalk is almost lacking (*T. Brassicae* Libert). The head is at first pulvinate or subhemispherical, red and subtranslucent, becoming yellowish red and opaque, sometimes pinkish red when it is covered by a dry mass of conidia. It is even at first, but may become irregularly tuberculate or cracked. The conidial mass is often very viscid, so that it adheres strongly to

anything which comes in contact with it, while in wet weather it may become so fluid that, if growing on a suberect branch, it will run down over the bark, uniting with those of other sporodochia in streaks. This deliquescence makes the shape of the head very variable, and, though usually circular at first, it may become, as noted by Persoon, oblong or angular. When the conidia have been partly washed off, the head may have a white margin (*T. ciliata* Ditm.), or may be mottled with white patches. The exposed conidiophores sometimes turn red. If practically all the conidia have disappeared, the surface of the stroma is white, or sometimes red, and minutely tomentose.

Externally, the stalk is at first reddish, but ultimately it becomes white, or white with a reddish tinge. Internally, the stroma is red or purple-red and subtranslucent at first, the colour becoming paler towards the exterior, but increasing in intensity in the centre down to the base. As the stroma ages, the red colour becomes concentrated in definite regions, the remainder of the stalk becoming white. Most generally, the colour is concentrated at the base of the stalk, so that if the sporodochium is broken out of its socket, a vivid red patch is left. Sometimes it is concentrated in a transverse zone immediately below the stratum of conidiophores, which is a specific character of *T. subpedicellata* Schw.; or it may be concentrated in a central conical column, extending upwards from the base of the stalk (*T. longipes* Peyl). When the stroma has split vertically internally, the red colour may concentrate round the cavity, giving it the appearance of an embedded red perithecium in fresh specimens (*T. floccipes* Cda., and *T. vaginata* Cda.), but reddish brown and fibrillose when dry. All these variations have been observed, together with normal *T. vulgaris*, in an extensive development of sporodochia on the fallen trunk of a beech which had been blown down when living.

Although the coloration of the stroma is distinctive in fully developed, and especially in long-stalked, specimens, when fresh, it cannot be always employed to separate *T. minor* from *T. vulgaris* in dried material. If the specimens have been dried in an early stage, before the stroma has turned white, they do not become white internally, but, as in so many red, subtranslucent fungi the stroma dries pale yellow internally and externally, sometimes red at the base of the stalk. Then they are indistinguishable from typical *T. vulgaris*.

The stalk is often very thick, in comparison with the diameter of the head (*T. crassostipitata* Fuck.). Sometimes it is sheathed at the base, as though the growth of the outer tissue had failed to keep pace with that of the inner (*T. vaginata* Cda.). When old, stalked specimens may become funnel-shaped, red in the funnel, subsequently bleaching to white, with a lobed margin and sometimes a white disk of effete conidiophores in the funnel.

Internally, the stroma of form *minor* is parenchymatous, with more or less isodiametric cells at the base, but soon passing into parallel vertical files of elongated rectangular cells, especially in the centre. In stalked specimens, the outer layer of the stalk is composed of rectangular cells and is vertically fibrillose. Probably owing to its structure, the stroma appears to split vertically more readily than in typical *T. vulgaris*. Towards the upper part of the stroma, the elongated cells diminish to 6–8 μ diameter, stouter than the corresponding tissue in typical *T. vulgaris*, and the files frequently separate, so that the uppermost two or three segments are free. Two or three conidiophores arise from the apex of the uppermost cell, and, if the files have separated, from the two succeeding cells below.

The conidiophores are usually more or less straight, sometimes curved above, but rarely as strongly curved as those of typical *T. vulgaris*. They are of the same type as the latter, but *some* of them, in addition to short branches, have branches much longer than the length of a conidium and sometimes again branched. The conidia are hyaline, cylindrical, usually straight, or oblong-oval, or oval, or inequilaterally oval, sometimes wedge-shaped, $5–9 \times 2–3\,\mu$. The conidia are slightly broader than those of typical *T. vulgaris*, with a larger proportion of oval forms.

Examples of form *minor*, differing rather widely from one another, were found in December 1937 on pieces of the trunk of a walnut tree which had been blown down in May of that year and immediately sawn up and split into billets for firewood, the billets being stored in a heap under cover. One piece bore sporodochia on the outer surface of the bark, and also, the bark having been loosened, on the inner surface. The sporodochia on the exterior were "sessile", pink, crowded, with white tomentose tufts between them, or arose from white tomentose patches. Some of the heads were minutely tomentose with projecting conidiophores, and some bore projecting columns of conidiophores and conidia. The sporodochia on the inner surface of the bark were at first covered by a thin film of white mycelium, then emergent. At first sight it was thought that they had been attacked by a white Hyphomycete, but that proved to be incorrect. They were usually scattered, and distinctly stud-shaped, stalked, with an expanded discoid base, and a white, swollen, tomentose ring round the base of the stalk, which consisted of hyphae growing out more or less horizontally from the stalk. Some of these stromata also were tomentose with projecting conidiophores, but no conidiophores were found among the hyphae surrounding the base of the stalk. These examples are no doubt abnormal, owing to the peculiar situation in which they developed, but they are of interest in showing possible variations.

Sowerby's figure of *T. vulgaris* (*Clavaria coccinea*) in *English Fungi*, pl. 294 appears to be form *minor*.

T. Brassicae Libert, in Libert no. 1019, is form *minor*, as previously determined by Paoletti. *T. vulgaris* on decaying stalks of *Brassica* appears to be always form *minor*.

T. Coryli Paoletti is form *minor* from his figures and description. Paoletti described the stalk as "albido", but stated that the branches of the conidiophore were equal in length to the conidia. His figures, however, show some branches longer than the conidia, while the figures of the sporodochia show typical, stalked, confluent form *minor*.

T. Euonymi Roum., in Roum., *Fung. Sel. Gall. Exsicc.* no. 55, is form *minor*, as previously determined by Paoletti.

T. expallens Fr., was recorded by Fries, by name only, in the Index to *Systema Mycologicum*, and was listed by him again in *Summa Veg. Scand.* The description given in Saccardo (1886), "sporodochia subglobose, minute; stroma whitish, stratum of conidia roseo-pallid then yellowish; conidia ellipsoid, ends obtuse; on branches, especially of horse-chestnut in France and Belgium" was taken from Kickx (1867), who wrote "*T. expallens* Fr. in litt. ad Desm.", and cited Desm. *Pl. Crypt. France* fasc. 4, no. 172. Apparently, Desmazières had sent a specimen to Fries, who gave it a name, but did not publish a description. A specimen in Herb. Kew., Desm. *Crypt. France* Ser. 1, no. 172, named "*T. expallens* Fr. in litt.", contains weathered stromata of form *minor*, some of them attacked by a white Hyphomycete. It would appear that this must be regarded as a co-type.

T. floccosa Link (1816) was founded on a specimen sent to Link by Nees, who published another description of the same fungus in the following year (1817) under the name *T. velutipes*. According to Link, it was globose, pale red, minute, scarcely the size of a pin's head, covered above with white flocci. Nees stated that it was shortly stalked, with a rounded, even, cinnabar-red head, and a thick black, grey or white, tomentose stalk, expanded at the base into a floccose foot. Nees added that the fungus at first formed a disk of white flocci, with a blackish granular centre, under the epidermis, the flocci then growing over the blackish disk and developing into the sporodochium. In Herb. B.M., there is a specimen marked "*T. velutipes* Nees. In *Rhoe typhina*, ab auctore missa, Dr Schmidt", *ex* Herb. R. J. Shuttleworth, which agrees with Nees's description. The sporodochia are form *minor*. Where the epidermis has been removed, the host bears minute, flattened pulvinate, black cushions, greyish tomentose, with the tomentum sometimes spreading over the substratum. Internally, these cushions are fuscous, the discoloration extending into the underlying cortex, and they consist almost entirely of cortical cells, with a few projecting hyaline hyphae. There is no indication that these

cushions (? lenticels) are in any way connected with the *Tubercularia*, and any such association must have been accidental. A specimen in Herb. Kew., from ? Desmazières, labelled "*T. velutipes* Nees, ill. Persoon vidit, in ulmo, Chaumont Oise, Octob. 1822", contains sporodochia with a stout stalk, the stalk and the lower part of the head white tomentose, and is form *minor*, attacked by a white Hyphomycete.

T. hysterina Cda., from Corda's figure and description is a small form *minor*, scarcely emergent.

T. marginata Preuss, described from specimens on walnut, is form *minor*, with the conidia washed off the margin, as in *T. ciliata*, judging from the description.

T. pinastri Cda., was based on Libert, *Pl. Crypt. Arduennae* no. 296, on leaves of *Pinus*. The specimens, as previously determined by Paoletti, are form *minor*.

Fries did not include *T. minor* in his list of *Tubercularia* in *Systema Mycologicum*, though he mentioned it incidentally in his introduction to the genus and in a note under *T. herbarum*. *T. discoidea* and *T. confluens* were also omitted from the list, but, in the Index, Fries gave the former as a synonym of *T. minor* and the latter as a synonym of *T. vulgaris*. Consequently, Fries may be said to have preferred the name, *T. minor*, to the earliest name, *T. discoidea*, but the point is merely of academic interest.

Tubercularia and *Nectria*

Fries (1823) wrote that the stroma of *Nectria cinnabarina* was very near *Tubercularia*, "ne dicam idem". Later (1828), he stated that he had satisfied himself that *T. vulgaris* was not an autonomous plant, but an abortive state of *N. cinnabarina*. He also stated (1828), in describing *N. sinopica*, that its stroma was very thin and scarcely evident, but that it was more conspicuous when sterile, when it degenerated into *T. sarmentorum*. The connexion of *N. cinnabarina* with *T. vulgaris* is now accepted, but Fries was mistaken as regards *N. sinopica*.

In *Systema Mycologicum* (1832) Fries wrote, in his introduction to the genus *Tubercularia*, that species of *Tubercularia* with a red stratum of conidia closely resembled the stromata of the species of caespitose *Nectria* corresponding to each. Thus, *T. vulgaris* almost always occurred with *N. cinnabarina*, *T. lutescens* with *N. ochracea*, and *T. minor* with *N. coccinea*. As regards the last of these, it must be remembered that Fries's *N. coccinea* evidently covered several species. It has already been noted that *T. lutescens* and *N. ochracea* are merely yellow forms of *T. vulgaris* and *N. cinnabarina* respectively.

Tulasne (1865) fully described *Nectria ditissima* (*N. punicea*) with numerous conidial forms. He stated that the young stromata, the

Tubercularias, were pale rosy, produced only small conidia, and exactly resembled the sporodochia of *T. vulgaris*. But on the bark of elm, they were sometimes mixed with more pallid, *Fusarium* subicula, together with intermediate forms in such abundance that it could not be doubted that they were all the same fungus. The *Fusarium* conidia were cylindric-fusiform, arcuate, obtuse at both ends, subsessile, 5 to 7-septate when mature, up to 60–70 μ long and 5–7 μ broad. Other conidia, more numerous, were ovate or ovate-oblong, continuous, straight, 6–10 × 3·5 μ, apical on rather rigid conidiophores, 30-40 μ long, while others, much less numerous and varying greatly in size, were intermediate between the former two. Before the whole of the conidia had disappeared from the stroma, it became golden and produced numbers of perithecia.

Tulasne stated that the conidial fungus, if he was not mistaken, was sometimes called *Tubercularia minor*. There is little doubt that the rosy sporodochia observed by him were *T. minor* but his other observations are somewhat puzzling. Fuckel (1869) recorded *Nectria ditissima* on beech, and named the *Tubercularia* which occurred with it *T. crassostipitata*, but he stated that he had not observed the conidia described by Tulasne. I have not seen any *Fusarium* or septate conidium on any of my numerous collections of *T. minor*, on beech, elm, and other hosts, except in one instance, on *Euonymus*, in which a *Fusarium*, which does not agree with Tulasne's description, is parasitic on the *Tubercularia* stromata. This latter *Fusarium* has cylindric, one-septate conidia, 23–27 × 4 μ, apical on simple, septate conidiophores up to 40 μ long. But the *Fusarium* described by Tulasne does occur in cultures originating from ascospores of *Nectria punicea* (*N. ditissima*).

Professor F. T. Brooks has kindly furnished me with a culture obtained from ascospores of *Nectria punicea* on *Rhamnus frangula*, which I identified. The fungus forms white irregular masses, consisting of *Fusarium* conidia, 3 to 6-septate, but often vacuolate and appearing to have more septa, clavate or subcylindrical, straight or slightly curved, ends very obtuse, 36–80 × 6–8 μ. With these are numerous cylindrical or oval, continuous conidia, 9–14 × 4–5 μ, as well as cylindrical, one-septate conidia, about 18 × 5 μ, and wedge-shaped, continuous conidia, 15 × 6 μ. When old, many of the smaller conidia become oval, one-septate, with the cells strongly inflated, and resemble *Nectria* ascospores, 12–16 × 4–6 μ. At the base of the mass, a red parenchymatous stroma is formed, bearing closely-set immature perithecia, or bodies resembling perithecia. Chlamydospores, spherical or oval, are numerous, either terminal or intercalary on the hypha, or occupying the terminal segments of the *Fusarium* conidia. These conidia agree with those figured by Wollenweber (1926) for *N. ditissima*, *N. ditissima* var. *major*, and *N. punicea*, but I have not

observed in the culture anything resembling the conidia and conidiophores of *T. minor*.

Tulasne's observations, at least in part, agree with the results found by cultures from ascospores. It would appear that he observed the earlier stages of development of the stromata of *N. ditissima*, but that he was in error in including as belonging to them the stromata of *T. minor*. There is also the possibility that some of his observations may refer to a Hyphomycete which is commonly parasitic on *Tubercularia*. There is no evident explanation why *T. minor* so often occurs with *N. ditissima* (*N. punicea*).

In the type of *Nectria fuscopurpurea* Wakefield, on *Prunus*, the perithecia are usually smaller than those of *N. cinnabarina*, uniformly encrusted rather than warted, collapsing centrally and becoming pezizoid, and, in addition to normal ascospores of *N. cinnabarina*, have some ascospores two or three-septate, up to $33 \times 8{\cdot}5\,\mu$; these perithecia occur in contact with the sporodochia of *T. minor*. In another collection, on decaying stalks of *Brassica*, in company with *T. minor*, the perithecia are similar, and most of the ascospores are those of *N. cinnabarina*, but some ascospores are cylindrical, two-septate, with the extra septum in one half, $23\text{–}27 \times 5\text{–}7\,\mu$. In both examples, *N. fuscopurpurea* is accompanied by *T. minor*.

On the other hand, in a collection on horse-chestnut, the perithecia are warted, but may become cup-shaped on drying, while the ascospores are one-septate, fusoid, $15\text{–}30 \times 4\text{–}6\,\mu$, or one-septate, cylindrical, curved, with rounded ends, $30 \times 3\,\mu$, or one-septate, oblong-oval, from 12×6 to $27 \times 8\,\mu$, or two-septate, fusoid, $24\text{–}30 \times 5\text{–}7\,\mu$, some of the asci being immature, so that it is possible that the longer one-septate spores would have become two or three-septate later; but the accompanying sporodochia are typical *T. vulgaris*. In another collection on elm, the perithecia agree with those of *N. fuscopurpurea*, and the ascospores are one-septate, oblong, fusoid or oval, $12\text{–}20 \times 5\text{–}8\,\mu$, with many two-septate, $21\text{–}28 \times 6\text{–}8\,\mu$, and some three-septate, $22\text{–}30 \times 5\text{–}6\,\mu$; but the accompanying sporodochia are again typical *T. vulgaris*.

In contrast to the foregoing, a collection of typical *N. cinnabarina* on hawthorn and another on *Wistaria* are each accompanied by form *minor*.

Neither the uniform encrustation of the perithecium nor the collapsibility of the perithecia is constant for *N. fuscopurpurea*, and there remains only the occurrence of two or three-septate ascospores. But as most of the ascospores are those of *N. cinnabarina*, it would seem preferable to conclude that the longer, more septate ascospores are an abnormality, which is commoner in *N. cinnabarina* than has been suspected. It is evident from the foregoing records that *N. fuscopurpurea* cannot be separated from *N. cinnabarina* on the ground that it

occurs with *T. minor*, nor can *T. minor* be separated from *T. vulgaris* on the ground of a difference in their perithecial stages.

Wollenweber (1924, 1926) described, as the perithecial stage of *T. minor*, *Nectria cinnabarina* var. *minor*, which occurred with the sporodochia of the *Tubercularia*. The perithecia were gregarious, erumpent, globose, squamulose, red, with a papillate ostiolum, and measured 0·24–0·45 × 0·2–0·42 mm.; the paraphyses were filiform, four- to five-locular; and the ascospores one-septate, oblong, sometimes almost cylindrical, obtuse, straight or slightly curved, generally 12–16 × 4–4·5μ (10–20 × 3–5·5μ). He stated that it differed from *N. cinnabarina* in its smaller perithecia, ascospores and conidia. Apparently he did not observe long, two- or three-septate ascospores. It may be queried whether he would have made a new variety, except under the belief that *T. minor* is distinct from *T. vulgaris*.

Tubercularia herbarum Fr.

T. herbarum was described by Fries (1815) as rather large, sessile, subglobose, pale red, internally the same colour, gelatinous when moist, farinose when dry, and occurring on dead herbaceous stems, such as *Cucubalus tartaricus*. Link (1825) included it with Fries's description, giving *T. Artemisiae* Schum. as a synonym. In *Systema Mycologicum* (1832), Fries described it as innato-sessile, with a smooth, pallid (pallido expallente) stratum of conidia, and added that it was quite distinct, minute, pallid, with the habit of *T. persicina* (now *Tuberculina persicina*) but not erumpent. Corda (1829) described it as erumpent, innate, pallid, minute, with a wedge-shaped stroma which was purple internally and covered by a pallid stratum of ovate spores bound together by mucus. Corda's description was adopted by Saccardo (1886).

It seems scarcely possible to harmonize these descriptions. Fries said that *T. herbarum* was rare, and apparently it has not been issued in any exsiccatum. European specimens under this name in British herbaria are obviously misidentified.

Tubercularia versicolor Sacc.

This species was described by Saccardo as having minute sporodochia, sometimes flesh-coloured, sometimes greenish, with conidia apical on filiform conidiophores, ovoid-oblong, 7–9 × 3–3·5μ, flesh-coloured or greenish, and was figured by him in *Fungi Italici*, pl. 961. It occurred on twigs of box, and Saccardo stated that it was probably the conidial stage of *Nectria Desmazierii*. Neither the description nor the figure conveys much idea of the species, but fortunately Saccardo issued specimens in *Mycotheca Veneta* no. 564.

The sporodochia are circular, pulvinate, up to 1 mm. diameter, or confluent in flat, irregularly oval patches, up to 3 × 2 mm., usually

gregarious, white or pink, dry, not horny or subtranslucent, rather soft. Internally they are white and somewhat loose, with a superficial palisade layer of phialides, which are cylindrical, about 20μ long, $1\cdot5$–2μ diameter. The thicker examples are stratose internally, and may have three successive layers of phialides, separated by loosely interwoven hyphae. Thus the sporodochium is "perennial", and as the successive layers are formed before all the conidia of the previous layer have been dispersed, vertical lines of conidia are found embedded in the sporodochium with the old phialides. As noted by Saccardo, some sporodochia may turn green, and that zone of phialides then appears as a dark transverse line in a vertical section of the sporodochium, but the succeeding layers are normally coloured, pink or white. This colour change does not appear to be due to the growth of any other fungus, though conidia of *Penicillium* have been observed in a discoloured layer; a similar colour change occurs in the conidial masses of some species of *Aschersonia*. The conidia are hyaline, subcylindrical or oval, 4–9×2–3μ, sometimes subglobose, 3μ diameter. The base may be oblique in the subcylindrical conidia, and sometimes broadly apiculate in the oval conidia. They are produced in chains at the apices of the phialides.

At the margin of the sporodochium, it is sometimes possible to find free conidiophores which show how the loose stroma is built up. These conidiophores have a main stem, 2μ diameter, rather closely septate above, with a short branch from each node, each branch bearing one or a cluster of three phialides, which all attain the same level. The loose tissue beneath is formed by the interlacing and fusion of the branches, while the phialides form a continuous superficial layer. The branching is similar to that of a *Spicaria* or *Gliocladium*.

Paoletti stated that the conidiophores were septate, and separated readily into cylindrical joints. From his figure, it would appear that what he took for the stalks of the conidiophores were the chains of conidia embedded in the sporodochium.

Tubercularia versicolor was recorded as occurring in this country in Massee's *British Fungus Flora*, but I did not find any British specimens at Kew or the British Museum. It is, however, not uncommon, and frequently occurs in company with various species of *Nectria*. I have collections of it with *N. sinopica* on ivy, with *N. punicea* on broom, with *N. mammoidea* on sycamore, and with *N. coccinea* on elm. It may be that this species prefers bark which has been attacked by a *Nectria*, or that it prefers fungi in general, as I have another collection on the stalk of *Polyporus squamosus*.

A similar fungus was collected by Libert on decaying stalks of *Brassica*, and was issued in *Libert* no. suppl. 634 as *Dendrodochium rubellum* var. *Brassicae*. It forms minute, white or pink, pulvinate or subglobose sporodochia, about 0·5 mm. diameter, which become

confluent in small, flat patches and turn fawn-coloured when old. The sporodochia are usually closely gregarious and may cover a length of several inches. Internally they are loose, but in the larger examples are rather more compact than in *T. versicolor*, with a deeper conidiiferous layer. The latter appears in section to have septate phialides, but actually it has septate conidiophores, with lateral branches like those of *T. versicolor*, each branch terminating in a small cluster of phialides. The septa are those of the conidiophore, the phialides being shorter than those of *T. versicolor*, but of the same shape, cylindrical, 12 μ long, 2 μ diameter. In this species the conidiophores are fused at their bases, so that it has free, branched conidiophores and is probably correctly placed in *Dendrodochium*, though the type of branching is spicarioid, and not that usually associated with *Dendrodochium*. The conidia are hyaline, cylindrical or oblong-oval, $5-7 \times 2-3\,\mu$, sometimes subglobose, $4\,\mu$ diameter. I have not observed conidia in chains, nor have I found stratose sporodochia.

Dendrodochium rubellum var. *Brassicae* does not appear to have been recorded for this country, though it is quite common on decaying stalks of *Brassica*. It is, however, to be found in the herbaria of Kew and the British Museum, where it constitutes the chief part of the fungi now remaining on the type specimens of *Nectria Keithii* B. & Br., and *Nectria furfurella* B. & Br., both of which are on decaying stalks of *Brassica*.

Tubercularia nigricans (Bull.) Gmel.

This species was described and figured by Bulliard (1784) as *Tremella nigricans*, and was transferred to *Tubercularia* by Gmelin (1791), with the brief description, "at first red, then black". De Candolle (1805) stated that it greatly resembled *T. vulgaris*, but the sporodochia were larger and not contracted at the base, at first bright red, becoming covered with a white film and turning black when old, details taken or deduced from Bulliard's description and figures.

Link (1825) included it in his list of *Tubercularia*, and described it as rather large, immersed, red, arising from flocci, with a stratum of conidia of the same colour, the sporodochium and the stratum of conidia at length black. Link appears to have thought that the fungus first appeared as a patch of white hyphae, on which the stroma developed, as he described for *T. floccipes*, probably a misinterpretation of the white zone on the sporodochia in Bulliard's figures. Fries included it in *Systema Mycologicum* (1832) as *T. nigricans* DC., stating that it scarcely differed from *T. vulgaris*.

Sporodochia of *T. vulgaris* may blacken for various reasons, but the black examples are not always *T. nigricans*. I have, however, recently collected specimens which correspond with Bulliard's figures, though I have not seen any sporodochia which are covered by a white

film, other than those, commonly found, covered by white parasitic Hyphomycetes, which do not turn black. Bulliard's figures show rather flat sporodochia, some red, others black, others partly red and partly black, with a narrow, white, byssoid zone, surrounding the red area, which may be lateral or central. The peculiarity of these figures is the sharp contrast between the peripheral black zone and the normally red area of *T. vulgaris*.

The recent specimens occurred at North Wootton, on horse-chestnut and on elm, and at Steeton, Tadcaster, on sycamore, coll. W. G. Bramley, all in company with *T. vulgaris*. These show that *T. nigricans* is wholly or partially parasitized *T. vulgaris*. The totally black sporodochia, when viewed in section macroscopically, are dirty reddish below, with a black peripheral zone. In thin sections, by transmitted light, this peripheral zone is fuscous below, almost hyaline above, with an irregular black line at the outer edge. It consists of a basal zone of large-celled parenchyma, from which arise crowded, parallel conidiophores. These conidiophores are up to 150μ long, $1{\cdot}5$–2μ diameter, once or twice forked, regular, fuscous at the base, greenish hyaline above, and pass above into chains of cylindrical, truncate, greenish hyaline conidia, $6-12 \times 1{\cdot}5$–2μ. Stout, fuscous, irregular hyphae, 4μ diameter, run from the basal stroma, or from the base of the original *T. vulgaris* stroma, through the layer of conidiophores, often in coarse fascicles, and may terminate in conidiophores, or may spread out over the surface of the sporodochium in a single discontinuous layer. The colour of the sporodochium, however, appears to be due principally to that of the stratum of conidiophores. Very little of the original *Tubercularia* stroma may remain unaltered in these black sporodochia, and what there is may be permeated by fuscous hyphae.

In the sporodochia which bear a red patch, surrounded by a black zone, the structure of the black region is the same as that described above. But the red area consists of normal conidiophores and conidia of *T. vulgaris*, arising from normal stromatic tissue of that fungus and passing in a column through the conidial layer of the parasite.

The statement that the sporodochium of *T. nigricans* is at first red and finally black was no doubt a deduction from the fact that red, black, and partly red and partly black sporodochia occur together. But no conidiophores of *T. vulgaris* have been found beneath the black areas, and there is no evidence that the parasite grows gradually over the fully-developed sporodochia of *T. vulgaris*. From examination of these recent specimens it would appear that the sporodochium of the latter is attacked at an early stage. Some escape attack and are consequently red, others are completely attacked and are black, developing only the conidiophores of the parasite, while others have been only partly attacked and so have developed in part normally.

Whether the white fringe surrounding the red area in Bulliard's figures belongs to the parasite or to its host cannot be decided from the available specimens.

Nees sent a specimen to Link, named *T. mutabilis*, and it was published by Link (1825) under that name. According to the description it was at first red, then black, and Link stated that when young it was indistinguishable from *T. vulgaris*, but when old it became almost completely black, and that the change seemed to occur suddenly, unless it was that black and red examples occurred together from the beginning; it differed from *T. nigricans* in the absence of flocci. Link, however, was mistaken in believing that *T. nigricans* arose from a floccose stratum, and it seems most probable that *T. mutabilis* was *T. nigricans*. The only herbarium specimens I have found under the former name are *West. Herb. Crypt. Belg.* no. 1191 on *Kerria*; these in the specimen examined are simply *T. vulgaris*, and do not agree with Link's description.

Tulasne (1865) figured the conidiophore and conidia of this parasite of *T. vulgaris* as the conidial stage of *Nitschkea cupularis*, stating that the conidiophores broke up into truncate conidia, not more than 10 μ long. He described the affected stromata of *Nectria cinnabarina* as variegated with black, both inside and out, and sometimes wholly black, but it is uncertain how much of this was due to *Nitschkea* and how much to the parasite described above. There is no other record of such a conidial stage of *N. cupularis*, and the latter does not occur on my recent specimens. It has not been determined what the parasite which converts *T. vulgaris* into *T. nigricans* is, though it scarcely seems probable that it has not been described under some name or other. Apparently it should not be classed as a Hyphomycete, as it has a superficial layer of hyphae over the conidiophores. It does not agree with the description of *Cylindrocolla episphaeria* v. Höhnel, the spores of which were said to be $14–26 \times 3–3{\cdot}5\,\mu$.

Tubercularia granulata Pers.

This species was described by Persoon (1801) as subrotund, sordid red, surface rugoso-tuberculate. He added that it became sordid fuscous in colour, and was opaque, yellowish ochraceous internally, the surface undulato-rugose and rough here and there with unequal granules. It occurred rather rarely on branches of *Acer platanoides* and *A. pseudo-platanus*.

Fries (1815) described *T. liceoides* Fr. as gregarious, sessile, globose, with a fuscous, rufous brown, deciduous cortex, and an "argillaceo-rosea" powder covering the nucleus (stroma). He added that it was often confluent, smooth, granuliform, with granules the size of seeds of *Vicia*, rarely of *Pisum*; the cortex was rufo-fuscous or fuscous brown, ultimately deciduous, when a subcompact, copious, "argillaceo-

rosea" powder covered the stroma, which was rather hard and pallid internally, surrounded by a darker fuscous zone. It will be noted that the "granules" in Fries's description mean the whole sporodochia, while in Persoon's they are roughnesses on the surface of the individual sporodochium.

Link (1825) included *T. granulata* with the description, sporodochia immersed, white, stratum of conidia convex, sordid red, finally blackening; and *T. liceoides* with Fries's description, except that he altered "argillaceo-rosea" to "argillaceo-fusca".

In *Systema Mycologicum* (1832), Fries included *T. granulata* Pers. with the description, stratum of conidia rugose, sordid red, finally fuscous, margin naked, and added that it was always sordid and finally blackening, ultimately granuliform and compact, and then the outer hard stratum was loosened and the interior became powdery, in which last state it was *T. liceoides* Fr. Thus Fries withdrew *T. liceoides* as a synonym of *T. granulata*, but he does appear to have been quite decided about it, as in a later list (1849) he included *T. liceoides* as a species near *T. granulata*.

Wallroth (1833) gave a description of *T. granulata* which states that the sporodochium emits conidia in drops of liquid which do not flow over the surface, but harden like drops of gum, a statement which sounds fantastic, but one which might be true under some conditions.

The principal characters of *T. granulata*, according to the foregoing descriptions, are the granular surface of the sporodochium and its ultimate blackening. As regards the first, normal specimens of *T. vulgaris* often have an irregular or granular surface, so that this character does not separate *T. granulata* from the latter species. There remains, therefore, only the blackening of the sporodochium, which from Fries's account was a superficial blackening.

Discoloured sporodochia of *T. vulgaris* are quite common. They occur with normally coloured sporodochia, and may be sordid red, brownish red, brown or black, but the black specimens usually appear brown or dull orange when soaked in water. In general, the brown or black colour is confined to a superficial film, underneath which are normal conidiophores and conidia of *T. vulgaris*. The film binds together conidia and the tips of the conidiophores, and in herbarium specimens the embedded conidia may be brown. There is no general covering of foreign mycelium, but sometimes a few blackish or fuscous cells, cuboid, 4–5μ diameter, or oval, up to $9 \times 6\mu$, in short, irregular chains at the ends of fuscous hyphae, 2μ diameter, may be found. These are *Torula Tuberculariae* Nees. Brown or black amorphous bodies, and black stromatic bodies, oval, $34 \times 27\mu$, or globose, about 50μ diameter, sometimes occur, but neither these nor the chains of cells are ever sufficient to account for the general blackening, and they may be quite absent. In addition, one finds algal cells and

miscellaneous fungus spores on some specimens. The superficial film is insoluble in water, and it would appear that the mucus which normally involves the conidia has become changed at the surface of the sporodochium. The cause of this modification has not been ascertained. Ultimately the hard outer layer may break away, exposing the interior mass of conidiophores and conidia, in which state the fungus is *T. liceoides* Fr.

T. granulata, in Fries *Sclerom. Suec.* no. 257, agrees with the foregoing description. In Herb. British Museum, there is a specimen of *T. liceoides*, *ex* Herb. Shuttleworth, marked by Schmidt, "ab ipso", i.e. from Fries. It contains small, brown, regular, pulvinate sporodochia, which are *T. granulata*, and others pallid to brownish, with an irregular surface, the upper part of the sporodochium having broken away. A specimen from Greville, from woods in Durham, in Herb. Kew., determined as *T. liceoides*, is *T. granulata*, and does not differ from another Durham specimen from Greville, determined as the latter species.

Paoletti took as his example of *T. granulata*, a specimen in Saccardo *Mycoth. Venet.* no. 565, issued as *T. granulata f Robiniae Pseudacaciae*. From his description, his specimen was a plain, stalked form *minor*, and an examination of the exsiccatum cited confirmed that. It does not show the colours or the superficial film of *T. granulata*.

Corda (1838) described a variety *cava* of *T. granulata*. His figure of the vertical section shows a narrow transverse fissure near the upper surface of the sporodochium, and below that another, independent, laterally oval cavity. The transverse fissure is probably the initial stage of the scaling off. The lower oval cavity does not resemble that found in form *minor*, and it looks rather like the work of an insect. Von Thümen issued specimens on *Populus* in *Fungi Austriaci* as *T. cava*, but these are not hollow and are merely *T. granulata*. He also recorded *T. cava* from Siberia (1880), and stated that some of the conidia were almost subclavate, which makes it probable that he had form *minor*. In the latter instance, he described the conidia as cylindrical, ends rounded, $4-6 \times 2-5\mu$, and that measurement is quoted by Saccardo (1886), but it seems probable that the breadth given is a printer's error for 2·5.

Von Thümen also described a new species, *T. Berberidis*, and issued specimens of it in *Mycoth. Univ.* no. 696. The sporodochia in the Kew copy of this resemble a Discomycete. They have a well-developed, immersed stalk, and a concave, or plane, or slightly convex, reddish disk, with a brown, rounded margin, sometimes separated from the reddish disk by a circumferential furrow. Examination shows that the disk is composed of the conidiophores and conidia of *T. vulgaris*, while the brown margin has the surface structure of *T. granulata*. They are specimens of *T. granulata*, from the centre of which the continuous

outer layer has scaled off, as described by Fries for his *T. liceoides*. There is a similar specimen in Herb. Kew., marked by Berkeley, "*Sphaeria Berberidis* praecursor, Wansford, Norths., *ex* Herb. Berk.", and placed subsequently in the cover of *T. Berberidis*.

British species of *Tubercularia*

In 1836, Berkeley recorded for Britain *T. vulgaris* Tode, *T. granulata* Pers., and *T. nigricans* Link. He stated that the last-named was probably only a variety of *T. vulgaris*; that *T. discoidea* and *T. confluens* were forms of *T. vulgaris*; and that *T. minor* differed only in size, and was common on *Robinia Pseudacacia*. No further species were added by Berkeley and Broome in their *Notices of British Fungi*. In 1893, Massee enumerated seventeen British species, which are dealt with below, together with others, named in herbaria but apparently unrecorded as British.

T. vulgaris Tode. Common. The numerous herbarium specimens under this name have not been examined.

T. minor Link. A form of *T. vulgaris*. Common. Baxter no. 100 (as *T. discoidea*); on cherry laurel, Kew (Cooke), Herb. Kew. *T. minor* var. *Syringae* Cke. and Massee is ordinary form *minor*. Sowerby's figure of *Clavaria coccinea*, pl. 294, appears to be form *minor*.

T. granulata Pers. Modified *T. vulgaris*. Common. Numerous British specimens in Herb. Kew., including one from Durham (Greville), and another from Glamis (Herb. Berk.).

T. liceoides Fr. Dehisced *T. granulata*. A specimen in Herb. Kew. under this name, from woods in Durham (Greville), is *T. granulata*.

T. nigricans (Bull.) Gmel. Parasitized *T. vulgaris*. Recorded by Berkeley from King's Cliffe, Norths., but his specimen is not available. British specimens under this name are usually *T. granulata*, e.g. Vize, *Microfungi Britt.* no. 353, from Forden; specimen in Herb. B.M. from Bloxam without date or locality; Thirsk (J. G. Baker), Herb. Kew.; Bungay (Stock), with normal *T. vulgaris*, Herb. Kew. I have recent specimens of *T. nigricans* on elm and horse-chestnut from North Wootton, and on sycamore, Steeton, Yorks. (W. G. Bramley).

T. Aesculi Opiz. Specimen, Kew, October 1887 (Cooke), in Herb. Kew., is *T. vulgaris*.

T. Sambuci Cda. Rhodes 3313 is *T. vulgaris*. Specimen, Roehampton, 20 March 1887 (E. G. Baker), in Herb. Kew., is *T. vulgaris*. Kew, 18 April 1885 (Cooke), in Herb. Kew., is a *Fusarium*.

T. aquifolia Cke. & Massee. The type specimen is *T. vulgaris*.

T. conorum Cke. & Massee. The type is *T. vulgaris*.

T. sarmentorum Fr. The only British specimen under this name, on *Ptelea trifoliata*, Kew. (Massee), Herb. Kew., is *T. vulgaris* form *minor*.

T. subpedicellata Schw. The only British specimen, on lilac, Kew (Cooke), is *T. vulgaris* form *minor*. A North American specimen from Schweinitz in Herb. Kew. is now unserviceable.

T. Euonymi Roum. The only British specimen, Kew Gardens, September 1887, is *T. vulgaris* form *minor*.

T. herbarum Fr. British specimens under this name are misnamed. Specimen on *Dulcamara*, Kew, 1885 (Cooke), Herb. Kew., is *T. vulgaris* form *minor*. Another on *Anthriscus*, Honington, Suffolk (Cooke), Herb. Kew., is *Dendrodochium rubellum* var. *Brassicae* Libert.

T. Brassicae Libert. British specimens are *T. vulgaris* form *minor*.

T. Berberidis Thum. A British specimen in Herb. Kew., *ex* Herb. Berk., Wansford, is *T. granulata*, i.e. modified *T. vulgaris*.

T. floccosa Link. A specimen in Herb. Kew. under this name, on *Rhus radicans*, Kew (Cooke), is *T. vulgaris* becoming *T. granulata* and attacked by *Torula Tuberculariae* Nees.

T. expallens Fr. A specimen under this name in Herb. Kew., Kew Gardens, October 1887 (Cooke), is too immature for identification, but certainly not *T. expallens* and probably not *Tubercularia*.

T. Ligustri Cooke. There are several fungi in Cooke's type, but the one described, and figured by him in Herb. Kew., is *Dendrophoma pleurospora* Sacc.

T. versicolor Sacc. No British specimens, though it is not uncommon in this country. I have recent specimens from Norwich, North Wootton, Becca Park (Yorks.), Kinlet, and Dartington.

Thus the only species of *Tubercularia* known to occur in Britain are *T. vulgaris* and *T. versicolor*.

FUNGI PARASITIC ON *TUBERCULARIA* AND *NECTRIA*

In the host index to Saccardo, *Sylloge Fungorum* (vol. XIII), the following fungi are recorded as parasitic on *Tubercularia*—*Cladosporium penicillioides* Preuss, *Coniothyrium Tuberculariae* Pass., *Graphium pelitnopus* (Cda.) Sacc., *Oedocephalum glomerulosum* (Bull.) Sacc., *Sphaeria parasitans* Schw., *Torula Tuberculariae* Nees, and *Verticillium epimyces* B. & Br. The last-named was probably included in error, as this species was described from specimens on *Elaphomyces* (Tuberoideae). In the same volume, *Hormiactis Nectriae* Karst., is given on *N. coccinea*, and *Oospora nectriicola* Rich., on *N. Dahliae*. Grove (1885) recorded *Oospora candidula* Sacc., on *N. cinnabarina* in England, and Hennings described *Fusarium Nectriae-Turriae* P. Henn., on *N. Turriae* from Africa. Von Höhnel (1904) recorded *Oospora hyalinula* Sacc., on *N. Peziza*, and published (1917) the names of two new species, *Pedilospora episphaeria* and *Cylindrocolla episphaeria* on effete *N. cucurbitula*; his description of the latter was published by Weese (1924), but the former is apparently *nomen nudum*.

Oospora sp. indet.

This species occurred in abundance on *T. vulgaris* (including form *minor*) at North Wootton. It forms a compact, white or cream-coloured crust which ultimately covers the whole sporodochium and spreads out in a strigose patch over the bark. The basal hyphae are up to 6μ diameter. The conidiophores and conidia are very variable in size. In some specimens, the conidiophores are up to 100μ high, $5–6\mu$ diameter at the base, attenuated upwards to 2μ diameter at the truncate apex, sometimes curved at the base, simple or with one lateral branch, septate, hyaline, while the conidia are oblong-oval, with a broad, truncate apiculus, hyaline, smooth, $10–18 \times 4–6\mu$. In others, the conidiophores are the same shape, but about 40μ high, 3μ diameter below, tapering to 1μ at the apex, and the conidia oblong-oval, oval, or narrow-oval, sometimes fusoid, ends rounded, rarely with a truncate apiculus, $5–9 \times 1{\cdot}5–2{\cdot}5\mu$. Both forms may occur on the same sporodochium, but, in general, the smaller form is the more common and may be the only one present.

If a sporodochium on which the white crust is just beginning to develop, or a sporodochium from an infected group which does not bear any external sign of the parasite, is wetted and placed in a damp chamber, it usually produces, within twenty-four hours, long, scattered, hair-like conidiophores of the larger kind, with large conidia in long chains. But if it is left and allowed to become drier, these conidiophores are followed by the development of the continuous white crust and smaller conidiophores. Under natural conditions, chains of conidia are rarely seen, a cluster of three or four conidia adhering to the apex of the conidiophore. I have not been able to identify this species, and as it seems incredible that it should not have been described or recorded, it would appear best to leave it anonymous for the present.

As indicated above, sporodochia which are apparently unattacked may occur on a branch in close proximity to others which bear the white crust. The former, however, are usually infected, though the parasite has not developed far enough to be evident externally. They are usually deep red internally, and when a section is mounted in water, it exudes numbers of hyaline or reddish oil globules. The conidiophores do not separate readily from one another, as they do in normal *T. vulgaris*. Irregularly flexuose, hyaline hyphae, 1μ diameter, run transversely through the zone of *Tubercularia* conidiophores. Some of the conidiophores are normal in structure, 2μ diameter, but their contents are granular. Others are stouter, 3μ diameter, branched, with their contents aggregated into oily, irregularly cylindrical or oblong-oval masses, up to 9μ long. Long lengths of these stouter conidiophores lack conidia, but here and there one finds on

them the short lateral branches and apical conidia of *T. vulgaris*. It would appear that these abnormalities are due to the attack of the *Oospora* on the *Tubercularia* sporodochia. Such sporodochia appear to be most common in the early months of the year; I had great difficulty in finding normal sporodochia in my stick-heaps (apple, birch, etc.) in February.

The *Oospora* described above does not appear to agree with the brief description of *O. nectriicola* Richon. Richon (1889) named his species twice, first *O. nectriaecola* and again as *O. Sphaerella*. It occurred on *Nectria Dahliae* Richon, apparently a *Dialonectria*, of which he considered it the conidial stage. Some perithecia were covered with white tufts of short conidiophores, once or twice septate, which bore ovoid, hyaline conidia, at first in chains, then scattered. Dimensions were not given, and the details available are insufficient for determination. The species on *Tubercularia* described above forms a continuous crust, not tufts. Lindau, in *Rabh. Krypt. Flora*, VIII, 30 (date of part, May 1904) credited von Höhnel with the discovery of *O. nectriicola* on *N. Magnusiana*, but later in the same year von Höhnel (1904) stated that it was an insufficiently described species.

Oospora candidula Sacc., etc.

O. candidula was described and figured by Saccardo (1878) from specimens on leaves of *Acer*. At the same time, he referred to it a fungus found on decaying woody fungi, which he had previously assigned to *Torula candida* (Wallr.) Opiz in *Mycol. Venetae Specimen* (1873), 177. Saccardo's figure of the fungus on *Acer* shows short, equal conidiophores, not inflated at the base, bearing long chains of oval conidia, 5-6 × 3 μ.

O. candidula was recorded for England, on *Tubercularia vulgaris*, *Nectria cinnabarina*, and the adjacent bark, by Grove (1885), who repeated Saccardo's description. Through the kindness of Dr C. G. C. Chesters, I have been able to examine Grove's specimen. The *Oospora* forms small, white, floccose tufts, which bear short columns of conidia here and there. The conidiophores are short, equal or conoid, sometimes fusoid, about 25 μ high, 4 μ diameter below, 3 μ diameter above, each bearing an apical chain of conidia, broader than the conidiophore. The conidia are cuboid or cylindrical, or slightly barrel-shaped, sometimes broader than long, the smaller becoming subglobose, 3–6 × 4–5 μ. The chains of conidia from adjacent conidiophores sometimes adhere laterally. This is an *Oospora*, and it may be left under Saccardo's name, though the recorded range of hosts appears open to question.

Von Höhnel (1904) recorded another species, *O. hyalinula* Sacc., on *Nectria Peziza*, giving the conidia as oblong, straight, 5–7 × 2–2·5 μ (Saccardo gave the dimensions, 4–6 × 1·5–2 μ). He added that *O.*

candidula Sacc., was very similar, but had broader conidia (probably judging from the descriptions), and that *O. nectriicola* Rich., was insufficiently described, but probably identical with *O. hyalinula*. The last-named was originally described as parasitic on *Capnodium Footii* on Olive.

In August 1935, I collected a Hyphomycete at Helmsley, Yorks., on *Nectria coccinea* and the surrounding sycamore bark. The fungus forms small, loose, white tufts, bristling with columns of conidia. The basal hyphae are stout, septate, 4μ diameter, interwoven into a loose stroma, or running separately over the host. The conidiophores are rigid, erect, clustered, hyaline, or slightly fuscous at the base, white in mass, up to 50μ high, 4μ diameter and ovoid or conoid at the base, attenuated into a long, cylindrical tube, 2μ diameter, not septate, producing a persistent chain of cylindrical, truncate, hyaline conidia, $3\text{–}6 \times 2\mu$. The chains of conidia are often laterally adherent in columns, which appear as a series of bristles. This appears to be a *Chalara*, and I recorded it as *Chalara fusidioides* Cda., but it would seem probable that it is the fungus recorded by von Höhnel as *Oospora hyalinula*.

Torula Tuberculariae Nees

This species was figured by Corda (1829, pl. 47) as forming minute black spots or streaks on the sporodochia of *T. vulgaris*. Link (1824) founded for it a new genus, *Tetracolium*, but that has not been accepted. *Tetracolium* was defined as having decumbent, adpressed hyphae, with conidia in chains of four, but, as is shown in Corda's figure, there may be more than four "conidia" in a chain. The best examples I have seen of this species were on a specimen of *T. vulgaris* on *Rhus radicans*, collected at Kew and assigned by Cooke to *T. floccosa*. The mycelium is hyaline to fuscous, coarse and irregular, $2\text{–}4\mu$ diameter, repent, terminating in adpressed chains or clusters of blackish cells, cuboid, $4\text{–}12\mu$ broad, or ovoid, up to $9 \times 6\mu$. This species does not appear to occur in sufficient quantity to cause a general blackening of the sporodochium.

Some synonyms of *Tubercularia vulgaris*

T. Aesculi Opiz, in Corda, *Ic. Fung.*, I (1837), 4.
T. Ailanthi Cke., in *Grevillea*, XII (1883), 26.
T. aquifolia Cke. & Massee, in *Grevillea*, XVI (1887), 49.
T. Artemisiae Schum., *Enum. Plant. Saell.*, II (1803), 183.
T. conorum Cke. & Massee, in *Grevillea*, XVI (1887), 49.
T. lutescens Link, *Sp. Plant.*, VI, 2 (1825), 100.
T. Menispermi Fr., *Obs. Mycol.*, I (1815), 208.
T. Populi Schum., *Enum. Plant. Saell.*, II (1803), 184.
T. Pruni Schum., *Enum. Plant. Saell.*, II (1803), 183.

T. Rhamni Paol., in *Atti Soc. Ven. Trent.*, XI (1887), 59.
T. Ribesii Westend. (as var. *Ribesii*), *Les Cryptogames classes*, etc. (1854), 119.
T. Robiniae Kickx, *Fl. Crypt. Flandres*, II (1867), 106.
T. Sambuci Cda., *Ic. Fung.*, I (1837), 4.
T. sarmentorum Fr., *Obs. Mycol.*, I (1815), 208.

Form *minor* Link

T. Acaciae Fr., *Obs. Mycol.*, I (1815), 207.
T. Brassicae Lib., Herb. no. 1019; Saccardo, *Mich.* II (1882), 644
T. Castaneae Pers., *Synopsis* (1801), 114.
T. ciliata Ditm., *Sturm's Deutschl. Fl.*, III, I (1817), 29.
T. confluens Pers., *Synopsis* (1801), 113.
T. Coryli Paol., *Atti Soc. Ven. Trent.*, XI (1887), 59.
T. crassostipitata Fuck., *Symb. Mycol.* (1869), 180.
T. discoidea Pers., *Obs. Mycol.*, I (1796), 79.
T. Euonymi Roum., *Fung. Sel. Gall. Exsicc.* no. 55.
T. expallens Fr., *Syst. Mycol.*, Index, 197.
T. floccipes Cda., in *Sturm's Deutschl. Fl.*, III, 2 (1829), 53.
T. floccosa Link, Obs., etc., Diss. secunda. *Mag. d. Ges. nat. Freunde, Berlin*, VII (1816), 32.
T. hysterina Cda., *Ic. Fung.*, I (1837), 4.
T. longipes Peyl, in *Lotos*, VII (1857), 66.
T. marginata Preuss, *Fung. Hoyersw.* no. 163.
T. minor Link, *Sp. Plant.*, VI, 2 (1825), 100.
T. pinastri Cda., *Ic. Fung.*, III (1839), 33.
T. vaginata Cda., *Ic. Fung.*, I (1837), 4.
T. velutipes Nees, *System d. Pilze*, etc. (1817), 35.

Modified *T. vulgaris* (*T. granulata*)

T. Berberidis Thum., *Mycoth. Univ.* no. 696.
T. cava Thum., in *Bull. Soc. Impér. d. Naturalistes*, LV (1880), 203.
T. granulata Pers., *Synopsis* (1801), 113.
T. granulata var. *cava* Cda., *Ic. Fung.*, II (1838), 33.
T. liceoides Fr., *Obs. Mycol.*, I (1815), 208.

Parasitized *T. vulgaris*

T. mutabilis Nees, in Link, *Sp. Plant.*, VI, 2 (1825), 101.
T. nigricans (Bull.) Gmel., *Syst. Nat.*, ed. XIII, II, 2 (1791), 1482.

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NEW AND INTERESTING PLANT DISEASES

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(With Plate III)

4. Septoria leaf blotch of *Lobelia*

In August 1939 Mr W. Buddin sent me a badly diseased plant of *Lobelia syphilitica* var. *nana* obtained from a nursery near Maidenhead. Individual leaves exhibited irregular pallid spots or blotches, spreading inwards from the margins or tips, and bordered by rather broad, indefinite, pink or mauve-pink bands (Pl. III, fig. 1). Many of the older leaves had been killed by the disease and only the youngest foliage was unaffected. Numerous black pycnidia of a *Septoria* were present in small groups scattered over the upper, and occasionally the under surface of the affected leaves. They were 75–150 μ in diameter, with a clearly defined ostiole, and contained thread-like, hyaline spores, straight or slightly curved, with rounded ends, indistinctly septate, measuring 18–30 × 1–1·5 μ (average length 23 μ).

In the literature, species of *Septoria* have been recorded on *Lobelia* in North America and Germany. *Septoria Lobeliae* Peck was described from New York State by Peck (1874) on *Lobelia spicata*, the leaves of which exhibited pallid spots, round or often confluent, with black or purple-brown margins. The pycnidia were stated to be minute, numerous, black, adpressed, with simple filiform spores 17–25 μ long. The same species has also been listed from North America on *L. cardinalis*, *L. inflata* and *L. syphilitica*. According to Martin (1887) the pycnidia occur in clusters and are 100–130 μ in diameter, with spores measuring 26–40 × 1–1·5 μ, while Uppal (1925) cited the spore measurements as 14–34 (mostly 20–28) × about 2 μ. Two varieties of this species have been described. The pycnidia of *Septoria Lobeliae* Peck var. *berolinensis* Syd. (1899), on *Lobelia inflata* in Germany, are 80 μ in diameter, with unicellular spores 20–26 × 1·5 μ, and var. *Lobeliae-inflatae* Sacc. (1915), on the same host in North America, is said to differ from the type by the somewhat larger spores (28–30 × 1·8 μ). Both these varieties, however, agree substantially with the American conception of *Septoria Lobeliae* Peck. On the other hand, *S. Lobeliae-syphiliticae* P. Henn. (1895), on *Lobelia syphilitica* in Germany, with spores 44–55 × 1–1·5 μ, and *Septoria ramonensis* Syd. (1926), on *Lobelia laxiflora* in Costa Rica, with spore measurements of 27–55 × 2–2·5 μ, are evidently distinct.

Type material of these fungi was not available for examination, but there are three specimens in the Kew Herbarium which are referred to *Septoria Lobeliae* Peck. One of these is labelled "on *Lobelia*, first European record 24/2/10", and Miss E. M. Wakefield has kindly informed me that it had been collected at Geashill, King's Co., Ireland, and was identified by Massee. The host appears to be a form of *L. erinus* and the fungus agrees very well with my own material and with the description of *Septoria Lobeliae* Peck. The second specimen, distributed in Ell. & Ev. *N. Amer. Fungi*, 2nd ser. no. 1732 on *Lobelia inflata* from Massachusetts, appears to be the same fungus, though its spores on the whole are longer (24–39μ with an average of 30μ), and many of them are distinctly septate. The other specimen, collected in Costa Rica by F. L. Stevens, is a different species corresponding closely to the description of *Septoria ramonensis* Syd.

5. *Septoria* sp. and *Ascochyta bohemica* on *Campanula*

Specimens of *Campanula* grown on the same nursery as the *Lobelia* mentioned above, and examined at the same time, were affected by two distinct diseases. The foliage of *Campanula Raineri* showed irregular brown blotches, bounded at first by the veins, but later spreading over the leaves and killing them. Pycnidia of a species of *Septoria*, distinct from the one on the allied host *Lobelia*, were present in large numbers on the affected areas. They were scattered or aggregated, amphigenous, black, 60–105μ in diameter, with a well-defined ostiole up to 24μ across. The spores were more variable, longer and distinctly broader than those of *S. Lobeliae*, straight, or more often slightly or markedly curved, hyaline, aseptate or distinctly 1–3 septate, with rounded ends, 17–38 × 1·5–3μ (average length of 50 spores 27μ).

Septoria obscura Trail was recorded on living leaves of *Campanula rotundifolia* in Britain in 1889. Its pycnidia occur on round or irregular, dingy brown spots having narrow and indistinct dark borders, and are amphigenous, scattered, immersed, black and with short ostioles. The spores are cylindric-filiform, obtuse at the ends, curved, 3-septate, yellowish and measure 22–35 × 1·5μ. I have not examined material of this species but the fungus collected at Maidenhead does not appear to differ from the description of it except in the width and colour of the spores.

Ascochyta bohemica Kab. & Bub. was found on dead portions of the stems, petioles, leaves, calyces and withered petals of living plants of *Campanula betulaefolia*, as well as on the foliage of *C. Raineri*. The pycnidia were 90–180μ in diameter, scattered, immersed, indefinite, and pale brown, but darker or almost black around the clearly defined ostiole. The spores, which issued in tendrils, measured 12–21 × 4–6μ (mostly 18–19μ long) and were hyaline, continuous or one

septate, straight or slightly constricted at the septum, with one or more oil drops in each cell. The spores resembled those of *Stagonospora* except that none was found with more than one transverse wall.

Ascochyta bohemica was described on *Campanula Trachelium* in Bohemia in 1905, and has not previously been recorded in this country. Two Latvian specimens on *C. Trachelium* (ex. J. Smarods Herb.) in the Kew Herbarium have been examined. Both showed local hypertrophied spots on the veins, with only a few pycnidia. The spores in this material were rarely longer than 16 μ or broader than 4 μ.

6. Root and bulb rot of tulips caused by *Pythium*

A *Pythium* disease of forced tulips has occasionally been observed in recent years in England and on the Continent (Moore, 1939, p. 33). It is primarily a root trouble, but in the later stages of attack the bulbs of some varieties may also be affected. The disease was described and the first English records enumerated by Moore & Buddin (1937), and it has been observed since under glass in the varieties Prof. Rauwenhof (Hants, 1938), Allard Pierson (Lincs, 1938) and William Copland (Middlesex, 1939). Other specimens, examined at the end of November 1938, revealed that the disease may develop before the tulips are housed, and demonstrated the important bearing of high soil moisture on its appearance and severity. On a large nursery in Essex about 60,000 boxes of various commercial varieties of tulips, planted in unsterilized soil, had been plunged in a mixture of soil and ashes out of doors, preparatory to forcing. Heavy rain had fallen during October and November, and the bottom inch or two of soil in the boxes was practically waterlogged. Many of the plants in representative boxes of William Copland, William Pitt and Allard Pierson showed typical symptoms of *Pythium* root rot, and *Pythium* was isolated from the brown, decayed distal portions of affected roots. Although the bulbs and much of the older portions of the roots were still sound, severe losses during forcing appeared to be almost inevitable. Nevertheless, by taking the boxes indoors as soon as possible, allowing them to drain off on the staging, and subsequently reducing watering to a minimum, the disease was quickly checked, and a good stand of flowers was obtained from all boxes, with no obvious difference between those known to be affected and others unaffected when taken into the glass house.

The close relation existing between soil and weather conditions and attack by *Pythium* was confirmed in 1939, when this fungus was recognized for the first time as the cause of serious loss among tulips that had been grown in the open. The disease occurred on a nursery in Buckinghamshire, where the soil is in part a heavy, binding loam, in part a light loam on gravel and in part intermediate in nature.

The weather in the district was cloudy, cool and dry for some weeks until mid-July, but rain, at times heavy, fell almost every day from then until about 10 August. Subsequently there was a hot, dry spell with day temperatures of 21–24° C. in the shade until 24 August.

On the nursery in question tulip lifting is normally begun in mid-June and finished by mid-July. In 1939, however, owing to the hard condition of the soil, few bulbs were lifted before mid-July and the operation was not completed until early August. Each day the bulbs that had been dug were taken to sheds for cleaning prior to storage. Growth during the season had been normal and the disease was not observed until the bulbs were being cleaned, and then only in those lifted after the wet weather had begun. The amount of disease was negligible in the stocks grown on the light soil and although more was present in those from the medium loam it was only in stocks taken from the heavy land that severe loss was experienced. Prince of Orange was the most susceptible of the varieties grown, and nearly 20 % of the bulbs of this variety grown on the heavier land had to be discarded, while the same stock on the lighter soils yielded very few diseased bulbs. Other affected varieties were Duchess of Hohenberg and Paul Eudel on the heavy land, Formosa and La Merveille on the medium soil and Purple Celeste on the gravel.

The disease was undoubtedly aggravated by the hot spell of weather in August, for in some stocks many slightly infected bulbs, overlooked during cleaning on 14 August, were brown and soft four days later. These were removed and, once day temperatures had fallen, little further trouble was experienced.

The badly affected bulbs were brown, soft and rubbery or reduced to a slimy, dirty yellow mass. The internal parts of others were still white and sound, but the outer fleshy scale was wet, soft and sticky, and dull white or pale yellow-brown, often with a well-marked yellow or brown line between the healthy and diseased parts. Slightly attacked bulbs showed partial or complete rotting of the basal plate and of the young bud within the bulb. Species of *Penicillium* and *Fusarium* sometimes developed in profusion on the outer scales in the later stages of attack, but the only constantly occurring organism was *Pythium*, and two strains of this were isolated in pure culture. One of these exhibited the characteristic features of *Pythium ultimum* Trow; in cultures on oat extract agar its conidia measured 22–31 μ (average 25 μ) and oospores 16–21 μ, the latter with walls about 2 μ thick. The antheridia were mostly androgynous. The other strain did not produce sexual organs and could not be identified, though it resembled the form previously found in England under glass (Moore & Buddin, 1937). On the whole its conidia were slightly smaller (21–28 μ in diameter) on oat extract agar than those of *P. ultimum*.

In late September a dozen healthy Prince of Orange bulbs were

Fig. 2

Fig. 1

inoculated with pure cultures of one or other of these two strains, through wounds made in the basal plate, and the bulbs were left standing on about ⅛ in. of water on the bottom of closed glass dishes kept at 22° C. Within four days both strains of the fungus spread rapidly through the bulbs; these all became soft and rubbery and closely similar in appearance to bulbs naturally infected (Pl. III, fig. 2). Others treated in the same manner, except that the fungus was not inserted into the wounds, remained sound. A second batch of inoculated Prince of Orange bulbs was placed in dry, open glass dishes kept in an unheated room. After a fortnight, during which the temperature ranged from 7–14° C., the greater part of one bulb had become soft and rubbery and three others exhibited slight rotting of the young bud and adjacent scales, but the remaining six bulbs and the uninoculated controls were still sound.

When bulbs slightly or moderately attacked by *Pythium* rot were kept in cool, airy sheds on the nursery the disease was soon checked. The affected parts remained brown and relatively soft, or the outer scales or the whole bulb became white and chalky or hard and calcified. It then became extremely difficult to demonstrate the presence of the *Pythium* in the tissues, and the appearance of the bulbs was typical of Chalking (Chalkiness), a condition which appears to be the final stage in a series of changes, induced by several different parasitic or non-parasitic causes (Moore, 1939, p. 41). Chalking had been noticeable among stored bulbs at this nursery in previous years, especially in 1935 and 1938, and most of it may well have been a result of attack by *Pythium*. The only previous occasion on which the *Pythium* was actually observed in association with Chalking, however, occurred in August 1938, when it was isolated from soft rotten tissue at the base of one or two affected bulbs of Paul Eudel.

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EXPLANATION OF PLATE III

Fig. 1. Leaf of *Lobelia syphilitica nana* (enlarged) attacked by *Septoria Lobeliae* Peck.

Fig. 2. Prince of Orange tulip bulb artificially infected with *Pythium* rot. Inoculated 27 September 1939. Kept four days at 22° C. and then left in open dish on laboratory bench until photographed on 16 October.

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SOME PROBLEMS OF COLLECTING LARGER FUNGI IN THE TROPICS

By G. B. MASEFIELD, M.A., A.I.C.T.A.

The object of this paper is to draw attention to some of the difficulties, which may not be realized by mycologists in Britain, experienced by collectors in tropical countries; and to discuss ways in which the situation might be improved. Amongst these will be included co-operation by mycologists and institutions at home.

Let us consider first the outstanding features of the larger fungus flora which has to be studied. The remarks which I shall make are based on some experience of collecting in the West Indies and in Uganda. Both these territories are marked on vegetational maps as areas of "moist tropical rain forest". In face of the picture of luxuriant vegetation which this conjures up, the newcomer is surprised to find that even in the forests of these countries the larger fungi are less noticeable in numbers than in an English wood in autumn. This applies particularly to the ground species of saprophytes; parasites on trees and bracket forms on old wood are more abundant, and are probably as plentiful as in the British Isles.

If we turn to the grassland and scrub zones outside the forests, the paucity is even more striking. True grassland species appear to be distinctly rare, a large number of the fungi which are found in these situations turning out on closer inspection to be coprophilous or growing on buried wood. An interesting point in the vast areas of short-grass plains in East Africa is that coprophilous fungi appear chiefly on the droppings of two animals—cattle and elephants. The latter is a particularly rich substratum, and as there are some 20,000 of these beasts in Uganda this is quite an important ecological site! The dung of buck and other game carries far fewer of the larger fungi.

To this general scarcity must be added the fact that there are prolonged dry periods in Uganda during which large fungi other than wood-growing species are very hard to find. The amateur collector is further discouraged by the fact that few of the tropical fungi are large or of striking appearance; the majority are small, dull-coloured, and not of the genera which are most easily distinguishable. The absence of some of the most striking genera which occur in temperate Europe is rather remarkable. In five years in the tropics I have not collected a *Boletus*, a *Lactarius*, or a *Russula*. Amongst other genera of representative groups which do not seem to occur are *Amanita*, *Morchella*,

Dacryomyces, and many of the less common British genera. In compensation for this, it is only rarely that one collects a fungus which is undoubtedly of a non-British genus.

These facts open up the first lines of research, which must be ecological. Why is there this paucity of individual fungi, and possibly also of species, in at least some tropical countries? Two solutions immediately suggest themselves. The first is that climatic conditions, and particularly rainfall, may be unsuitable. Most parts of Uganda have an average annual rainfall of something like forty or fifty inches, which is not high for a tropical country; and this may be unfortunate for the fungus collector. Some support is lent to this view by the fact that in the forests of the Sese Islands in Lake Victoria, with an average rainfall of some eighty inches, large fungi are particularly abundant; this applies in a lesser degree to the other forests of the lake region, some of the fungus flora of which has been listed by Maitland & Wakefield (*Kew Bulletin*, 1917). On the other hand, fungi are not particularly abundant at high altitudes on the mountains of Uganda, where conditions are cooler and moister than in the plains and more like those of Europe. It is true that at one season of the year I found large fungi rather abundant in the bamboo forest of the Mufumbiro volcanoes in south-west Uganda; but my general impression is not one of abundance, and in the forests of Mount Elgon I have not found many fungi.

A second possibility is that in these regions the ecological competitors of the larger fungi—bacteria, moulds, termites and other insects—destroy the available substrata too quickly for these fungi to get a hold. The termites may, I think, be ruled out because fungi are not noticeably more abundant above altitudes of about 6000 ft. where termite depredations are rare or absent. The other possibilities require investigation, and a microscopic study of mycelia and structural decay in rotting humus from tropical forests might yield results of great interest.

Another quite different line of ecological research might be based on the non-appearance in tropical floras of common European genera, as mentioned above. A linked study of intermediate regions such as the Near East might perhaps give the key to the geographical distribution of some of these fungi.

Another aspect perhaps worth investigation is the edible qualities of local fungi, many of which are eaten by native tribes. A list of thirty or forty such species with distinct names in various native languages of Uganda can be obtained without any difficulty.

Let us now turn from the ecological to the systematic aspect. Here the newcomer to a tropical country finds his chief difficulty in the lack of any available literature and of records of previous collections. In Uganda the Government Mycologist has collated a list of Hymeno-

mycetes so far recorded in the country, which comes to a total of 224 species, of which a few are synonyms. Many of these species are described in publications which are difficult to obtain, and for some of them there is actually no description available in the country. This list, as would be the case in most tropical countries, had grown in a very haphazard way; within a few months of arriving in the country I had collected such well-known species as *Psaliota campestris*, *Lepiota procera*, and *Laccaria laccata*, none of which genera had been recorded in Uganda before.

This instance will serve to show both the difficulties and the scope which lie before the tropical collector. I will illustrate further by reference to the genus *Lepiota*, which I have recently had occasion to study. This is a most useful genus for distribution studies, since it seems to be represented by fairly numerous species all over the world.

Saccardo in *Sylloge Fungorum*, vol. v, lists 186 species of this genus, and there are further species in the supplementary volumes. Rea lists 68 species from Great Britain; Velenovsky 46 for Czecho-Slovakia; Saccardo 55 for Italy; Migula 57 for Germany; Murrill 85 for North America, including Mexico and a few records from the Caribbean area. It is interesting to compare with these the longest lists which I have been able to find for tropical or semi-tropical countries. Berkeley & Broome originally in 1871, listed 68 species from Ceylon and more may have been added since as Ceylon has been one of the parts of the tropics best explored mycologically (e.g. Petch's long series of records in all groups, including many Hymenomycetes). Butler & Bisby give 29 Lepiotas for India; van Overeem-de Haas only 5 for the Dutch East Indies. Rick gives 92 for Brazil, of which 17 are new species.

A further point of interest is to compare the numbers of species common to both temperate and tropical zones in the above lists. Taking first the lists for the Old World, there are twelve species common to both temperate and tropical zones excluding Ceylon; for the New World, there are ten species common to North America and Brazil. These figures are of interest as showing how large a proportion of the tropical species are not included in the temperate floras; most species which are not so included being doubly difficult to find in books which are likely to be available.

Having indicated some of the difficulties which meet the collector in the tropics, let us consider what might be done to remedy them. A central body at home might help a great deal by collating a list of larger fungi which have already been identified in British tropical dependencies; such a list, however, will lose half its value if it is confined to a restricted group such as the African colonies (for which the idea of a list has been suggested before), and if descriptions of the species are not included as well as records. The existence of such a list

would probably lead to the filling of many gaps in the flora of individual territories.

Even with such aid, however, there will remain a large number of species which cannot be identified either in the field or at the capitals of most Colonies. Such species have to be sent to Europe before their identity can be determined. For a certain number of bracket forms and tough fungi it is possible to do this, with the result that such groups at present dominate the lists of recorded fungi in many tropical countries. But even with these species there are difficulties. The identifications often take months to come back from Europe, and meanwhile the duplicate specimens which have been kept by the collector in a moist tropical climate have succumbed to the attacks of moulds or insects. The keeping of large specimens preserved in fluid is not satisfactory either for the structure of the fungus or for the amount of space and preservatives required.

There remains a vast majority of the larger fungi which cannot be dried. The best that can be done with these at present is to make careful notes and drawings, with material in preservative, and a sketch to show the fresh appearance; the drab colours and small size of most tropical species do not lend themselves to the assistance of the amateur artist. Such notes should, however, enable a collector to recognize a species when he collects it for a second time. It seems to me that by this means it might be possible, at the capital of a Colony, to keep records under tentative names of many fungi which cannot at present be definitively named. For example, any species collected locally and for which a clear description with drawings was available might be listed as "Probable Genus X—No. Y"; and this number and notes would be available for use by later collectors. Thus considerable ecological knowledge might be amassed about a species whose systematic position was still uncertain; and at a later date a name could be given to it.

This would most easily be done by a visiting expert; and such visits are the last point which I wish to advocate for the assistance of tropical mycology. There is no doubt that our knowledge of many tropical floras might be enormously increased by visits from expert mycologists, especially those versed in specialized groups; is it too much to hope that such visits might one day be sponsored by a body such as the British Mycological Society? They would do much to loosen the Gordian knot which is at present hampering our advance in knowledge; that the man on the spot makes repeated collections of common fungi which he cannot identify, and the expert who could identify them cannot see them.

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A LIFE CYCLE OF *BLASTOCLADIA PRINGSHEIMII* REINSCH.

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(With 9 Text-figures)

Introduction

To students of the Phycomycetes perhaps the most interesting work of recent years is that of Kniep (1929) on the water mould *Allomyces javanicus*. When he announced that this fungus produces two kinds of motile gamete, a micro- and a mega-gamete which fuse to originate a zygote, he described a phenomenon unique among the fungi. Isogamy was known among many chytrids; so were the oosphere and motile microgamete of *Monoblepharis sphaerica*; but the heterogamy of flagellate gametes was new. His further description (1930) of an alternation of generations—of a sporophyte with a gametophyte of similar appearance—intensified mycological interest.

Butler (1911) founded the genus *Allomyces* on *A. arbuscula* and included it with *Blastocladia* in a group Blastocladiaceae, chiefly on the character of the resistant sporangium and the absence of cellulose in the hyphal wall. The two genera have other features in common, viz. the vegetative part of the thallus mainly rhizoidal; the reproductive part with a stout main axis, bearing more slender branches; and thin-walled sporangia, bearing zoospores with one posterior flagellum.

The genus *Allomyces* thus brought into prominence has been intensively studied since Kniep's discovery. Emerson (1939) has suggested dividing the genus into three subgenera according to the different life cycles that have been observed, viz. *Eu-allomyces*, with alternation of equal sporophyte and gametophyte generation; *Brachy-allomyces*, without alternation of generations; *Cystogenes*, with encystment of swarmers.

Now although the genus *Blastocladia* has been known since Reinsch (1878) first described *B. Pringsheimii*, its life cycle has remained unknown.

Nearly twenty years later, Thaxter (1896) rediscovered the genus, described it more fully, and established a second species. Since then von Minden (1916) has published a morphological account of the group, adding two species; Cotner (1930), a cytological investigation of the zoospores; and Lloyd (1938), a comparative study of the vari-

able thallus of *B. Pringsheimii.* Otherwise there have only been records of the genus in various parts of the world, and the description of four or five new species.

The sporangia of Blastocladia

In spite of the recent claim made by Bessey (1939), it seems certain that, as in *Allomyces*, the swarmers from the thin-walled sporangia of *Blastocladia* spp. do not fuse. During the two years 1933–5, at frequent intervals, Lloyd (1938) watched swarmers liberated from these sporangia but never saw fusion: on the contrary she observed direct germination of the individual swarmers.

The morphological significance and function of the resistant sporangia (Fig. 1) have so far been a matter of conjecture (Blackwell, 1939).

Reinsch (1878) described these thick-walled resistant bodies as doubtful oospores, for they can slip out of their outermost thin wall which remains behind on the thallus. Kanouse (1927) accepted them as such and claimed that she had found an antheridium. Thaxter (1896), however, rightly compared them with the resting conidia of the Pythiaceae.

The secret of the life cycle lay with these resistant sporangia which had always defied germination in culture. Lately, it had been assumed that, on germination, they would liberate swarmers as in *Allomyces*, for the resistant sporangia of both genera resemble one another so closely in occurrence and in form, and are unlike those of any other fungus except the newly discovered genus *Blastocladiella*.

But what the swarmers, thus liberated, would become was quite unknown. When, therefore, abundant germination of the resistant sporangia of *Blastocladia Pringsheimii* was obtained in 1937, the fate of the swarmers was closely watched.

Source of the material

The plants of *B. Pringsheimii* used in this study were obtained from a tank in the greenhouse of the botanical garden, Royal Holloway College, and cultivated there and in jars of tap water in the laboratory, on tomatoes, grapes and other thin-skinned berries.

About a month after inoculation of the fruits, the fungus usually bore abundant resistant sporangia (Fig. 1 *a*); and these were germinated not less than three months later.

The fruits, or merely the skins of the fruits, bearing the colonies of fungi with resistant sporangia, had meanwhile been stored either in water, or between layers of plain agar, or, occasionally, dry. It was found essential that the resistant sporangia should be thoroughly ripe

before being stored, and that if stored dry, they should be dried slowly.

Formation and fate of the resistant sporangia

Time of appearance. Thin-walled sporangia always appear first. Exactly what causes the formation of resistant sporangia among the

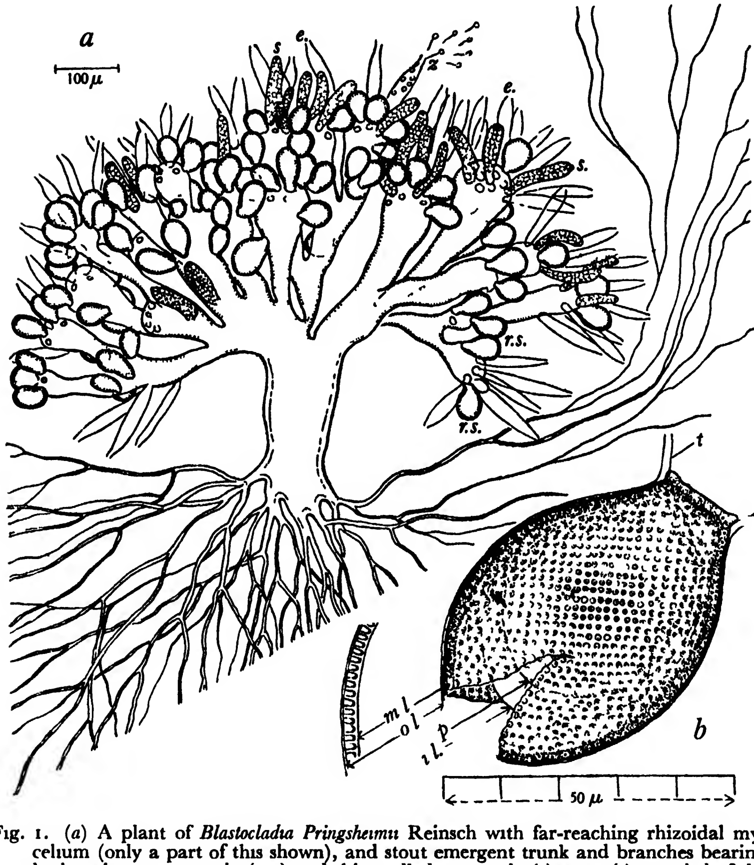


Fig. 1. (*a*) A plant of *Blastocladia Pringsheimii* Reinsch with far-reaching rhizoidal mycelium (only a part of this shown), and stout emergent trunk and branches bearing both resistant sporangia (*r.s.*) and thin-walled sporangia (*s*) some (*e*) emptied of the uni-flagellate zoospores (*z*). (*b*) A dried resistant sporangium cracked open and showing the three wall layers: the outermost (*o.l.*) continuous with the thallus wall (*t.*), the middle (*m.l.*) thickened and pitted (a portion is shown in section), and the innermost (*i.l.*) intact and somewhat withdrawn enclosing the still further contracted protoplast (*p*).

thin-walled sporangia is not known. The thallus must attain a certain age before producing them: thalli less than six days old have

never been found to bear them; on the other hand they may be eight or more weeks old and still not bear them. It seems that the fungus at all seasons may, or may not, produce them, and thalli grown under apparently similar external conditions behave differently.

Initiation. Resistant sporangia are initiated in much the same way as are thin-walled sporangia, and, until a cross-wall is formed at the base, neither sporangium can be distinguished from a young vegetative lobe of the thallus. The fact that a resistant sporangium can, rarely, be branched gives support to this close comparison with a vegetative lobe. The initials of all three are very soon multinucleate. Development begins very rapidly and the appearance of a cross-wall is the first distinguishing sign of sporangium formation. Simultaneous mitoses follow. Later the shape of the sporangium and the character of the wall distinguish the two kinds of sporangium.

Shape. The resistant sporangium is typically short and ovoid, whereas the thin-walled sporangium is long and cylindrical, but both types show a wide range of form. The exceptional occurrence of long cylindrical resistant sporangia suggests that the final character of the sporangium may be determined at a late phase of development.

Contents. The central vacuole is common to both types but is used for a store of fatty reserve material in the resistant sporangium.

Wall. The resistant sporangium develops the characteristic thick and pitted wall, while the other type develops a characteristic papilla just within the apex.

The wall of the resistant sporangium is three-layered (Fig. 1*b*):

(1) The outermost layer continuous with the thallus wall—the original wall and comparable with the wall of the non-resting sporangium.
(2) The middle, thickened, pitted layer.
(3) The innermost, a layer clearly seen on germination when it protrudes through a split in the thickened wall (Fig. 2). It is thin and extensible.

The thickened layer is often called the exospore, as in *Allomyces*, where the resistant sporangium usually slips out of the outermost layer which then appears like an investment or sac. In cultures of *Blastocladia Pringsheimii* however the resistant sporangium remains on the old thallus, or finally separates only by the rotting away of the old thallus below. It can, however, slip out of the investment and perhaps in nature it normally does this. The thallus wall forms a stiff collar in which the resistant sporangium is set.

Chemical nature of the pitted layer. The characteristic pitting of the middle layer, observed and figured by both Reinsch and Thaxter, is evident at a very early stage of development and forms quickly. It appears to be brought about by minute, round, regularly arranged areas on the outer face of this layer developing into some easily dis-

organized substance; while the rest, in honeycomb pattern, changes into a very resistant protein which gives some reactions for keratin, e.g. it stains pink with Millon's reagent and yellow with picric acid. There is no cellulose or fat in the wall and it is not chitinous. (Parallel observations and tests made on the middle layer of resistant sporangia of *Allomyces javanicus* and *A. arbuscula* have shown that although this layer is thicker than in species of *Blastocladia*, it does not give such a strong reaction for protein, e.g. it does not give such a definite pink colour with Millon's reagent. It may be that the different chemical nature of this layer explains the more resistant nature of the resistant sporangia of species of *Blastocladia*.)

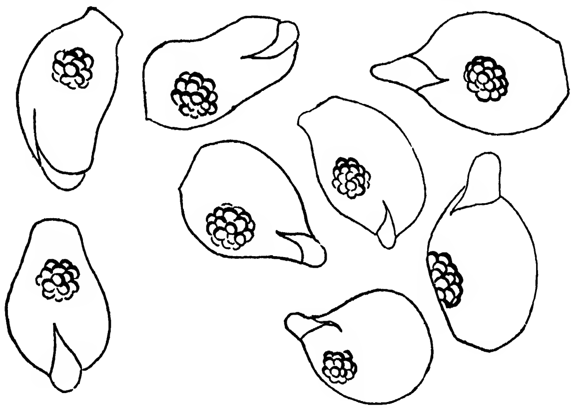


Fig. 2. Outline drawings of resistant sporangia in the first stage of germination. The shape of the sporangium is more or less ovoid. The groups of oil globules, the slit at the apex and the protruding innermost wall layer are constant features at this stage. The two on the left were found in May, stored in June, soaked 12 October and germinated 14 October 1938. The rest were found in May, stored in June, soaked 7 November and germinated 8 November 1939. The readier germination of older sporangia has been demonstrated on many other occasions. Magnification as in Fig. 3.

Distribution of pits. Since Emerson (1938) has shown that in *Allomyces*, the size and distribution of the pits is a useful diagnostic character in determining species, it is perhaps important to record that the pits of the resistant sporangia of *Blastocladia Pringsheimii* are about $2\,\mu$ apart; there are as a rule five or six pits to $11\,\mu$, the outside limits being four and a half to seven pits.

Germination of resistant sporangia

The resistant sporangia of *B. Pringsheimii* are notoriously resistant to attempts to induce germination, and the first record of successful germination occurs in a letter to *Nature* in November 1937.

After this announcement was made (Blackwell, 1937), it was found

that von Minden (1916) had illustrated three cracked resistant sporangia, each with papilla emerging; he stated, however, that he did not see swarmers liberated, although he saw them outlined within the sporangium. Later it was learned that in February 1937, Emerson had not only germinated resistant sporangia of *B. Pringsheimii* but had also cultivated the germlings from the liberated swarmers. He had not, however, recorded this, and so it was not generally known.

Conditions of germination

It is not possible as yet to give precisely the conditions required for germination. Like so many resistant spores of fungi, out of a great number, treated apparently just alike, a few now, and a few later after different intervals, will germinate. Undoubtedly spores vary among themselves in thickness of wall, in size and in quantity of reserve material.

But certain general facts have been established about resistant spores and sporangia:

(1) They must be thoroughly ripe before they are stored; and they may then be stored wet or dry.

(2) They require a period of "after-ripening", the length of which no doubt depends in part on temperature: the resistant sporangia of *B. Pringsheimii* have not, as yet, been germinated under three or four months without special "coaxing".

(3) One form of "coaxing" is to subject the mature spores to periods of alternating dry and wet conditions and to periods of alternating heat and cold. Mechanical, physical and chemical factors all play a part in cracking a thick wall.

(4) *To induce germination*, water is essential. It is assumed that oxygen is essential too but it is an immeasurably small amount. The oxygen dissolved in the water-film under a coverslip is adequate.

(5) *To control germination*, it is advisable to store the spores almost dry because in water they will ultimately germinate spontaneously, one at a time, and as by that time they have dropped from the old plant it is not easy to find them.

These sporangia are not only resistant but accommodate themselves to the environment. If right conditions for germination do not arise they can continue resting for months; if right conditions are interrupted they can resume a resting state. A high percentage of germination has been obtained in resistant sporangia kept under a coverslip for nearly seven weeks, sometimes wet and sometimes dry.

Germination

When ready to germinate, the resistant sporangium has a group of oil globules, balled in the centre (Fig. 2). This is a sure sign of active preparation for germination. It is no doubt the result of the breaking

up of the fat vacuole. The rest of the protoplasm is clear and transparent.

The thick, pitted, middle wall-layer cracks across the apex, and the thin innermost layer, now exposed, stretches to accommodate the swelling protoplast within. By and by a small papilla develops (Fig. 3): less frequently two papillae (Fig. 4).

The resistant sporangium may remain thus for several hours with no external change except perhaps a further swelling causing a larger bulge of the innermost wall, but with considerable internal change. It may go no further than this. Under favourable conditions, however, it liberates swarmers twelve hours after the fresh water is first supplied to the resistant sporangium.

Formation of the swarmers

Just before the multinucleate protoplast is cut up into swarmers, the cluster of oil globules disperses throughout the protoplasm and the resulting smaller globules are included unequally in the swarmers. At this stage the resistant sporangium, with the unequal and irregularly distributed globules, looks not unlike a resistant sporangium that has disorganized. But within a few moments the swarmers are formed and can be seen heavily moving on one another (Fig. 3).

Emission of the swarmers

Then the papilla gives way. If there are two papillae both may dissolve together (Fig. 4*b*). A few swarmers pass out and are held for a moment in what might be interpreted as a quickly evanescent vesicle, and then break free and roll slowly away. The rest of the swarmers (forty or thereabouts according to the size of the resistant sporangium) then squeeze through the small opening left by the dissolved papilla—one, two or three a minute. The sporangium may be emptied in fifteen minutes or take as long as an hour.

Each swarmer moves freely within the resistant sporangium until impelled towards the opening. In the early stages of emission swarmers crowd to the opening and sometimes attempt to push through two together (Fig. 3). As soon as one is through there is another pressing into the opening. In the later stages they charge the opening, attempting to get through, even when only one or two are left and yet they always squeeze through with an effort. They are of different sizes and contain by chance different quantities of oil globules.

The emission of swarmers is not unlike that from the thin-walled sporangium but measurements indicate that they are larger.

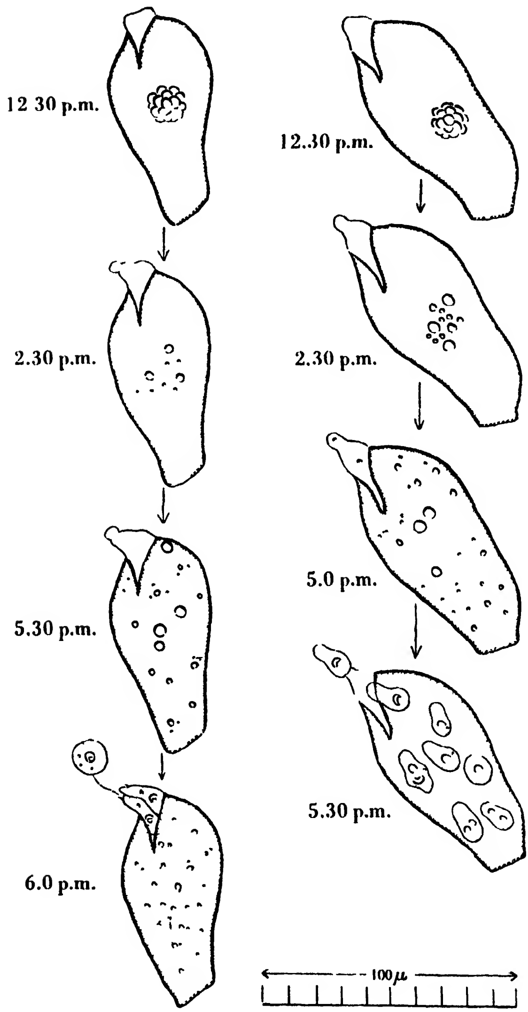


Fig. 3. Successive drawings of two resistant sporangia under observation during germination from 12.30 p.m. to 6.15 p.m. 16 February 1939. Stages in germination shown: the cluster of oil globules disperses; the papilla forms; movement of oil drops reveals great activity of protoplasmic contents; the protoplast is cleft into spores; the papilla dissolves, and appears to be continually re-formed by the pellucid (non-flagellate) end of each next emerging swarmer; the spores escape rapidly (in the right-hand one the last few emerged slowly: the left-hand one was emptied in fifteen minutes).

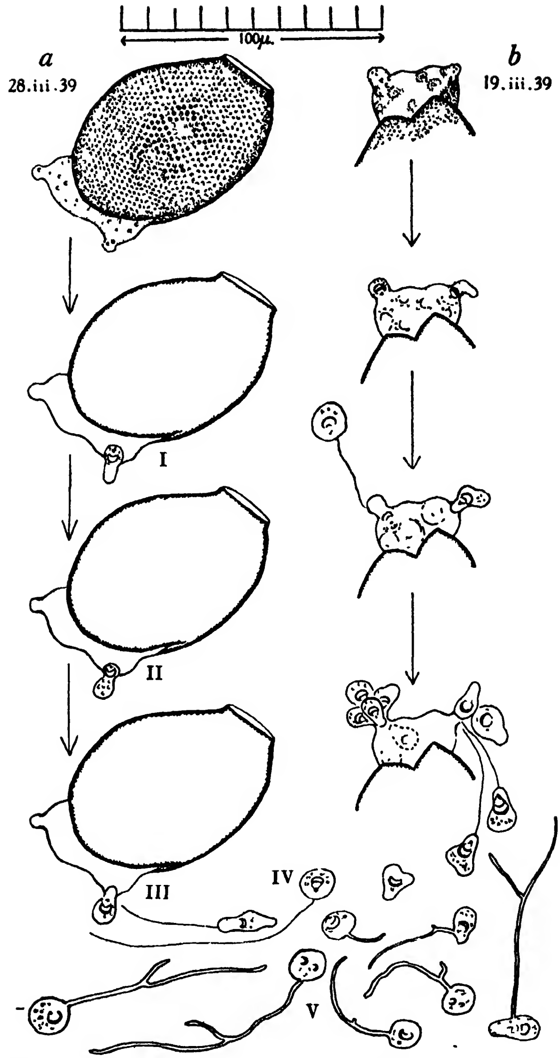


Fig. 4. Successive drawings of two sporangia, each with two papillae, under observation during germination on 19 and 28 March 1939. In (*b*) (only apex shown) the two papillae dissolved almost simultaneously and emitted swarmers together. The earliest swarmers to emerge appear to replace the papilla. A pellucid pseudopodium appears at the orifice and swells (I). Tiny oil globules surge into it until the more fluid cytoplasm of the swarmer has passed out (II). Then with an effort the more solid nucleus is discharged into this projecting part of the swarmer (III) and the swarmer is free (IV). Later swarmers escape more easily and several may attempt to push through the orifice together (*b*). Swarmers are often held awhile at the orifice by the flagellum. They may become amoeboid while straining to escape. Germination (V) follows immediately.

The swarmers free

Once free, the swarmer often lies quiescent recovering the spherical shape which it bore within the resistant sporangium, but lost on squeezing through. It then begins to quiver as the flagellum comes into play. The flagellum sometimes catches in the opening and holds the swarmer, straining to escape, which it finally does with a quick movement. But if not caught, the swarmer slowly, softly rolls away, with a forward spiral movement, and a little later swims actively along, always, however, with a rolling motion, and with the flagellum trailing behind. The swarmer by this time is slightly elongated and in its free-swimming state is ovoid.

Under exceptional circumstances the swarmers have an amoeboid phase immediately on emission. The active swarmers may remain active for a day, with periods of amoeboid form and movement. These amoebae have a clear ectoplasm and change their form rapidly: almost too rapidly for the pencil to record. The amoeboid state can be changed to the swimming state by the addition of water.

Germination of the swarmers

After a day or less, the ovoid swarmer ceases motility and settles down as a spherical unicell and puts out a thin germ-tube. This is the rhizoidal hypha which after growing to several times the length of the spore puts out an equally thin branch. Only after this long, branched, rhizoidal hypha has developed does the body of the swarmer swell and the nucleus divide. It grows into a characteristic horizontal club-shaped hypha which is the sporangium-bearing part of the thallus. It may bear a sporangium at once or only after further growth and branching (Figs. 5, 7, 9).

Naturally occurring germlings from resistant sporangia swarmers may be found established in a bed of bacteria or at the edge of a morsel of vegetable matter. They have been grown to maturity in three artificial habitats: (1) in a jar of water, in mass cultures on the surface of tomatoes, (2) on microscope slides, under a coverslip ringed with corn meal agar, (3) in Petri dishes, in pure culture on corn meal agar.

(1) *Plants on tomatoes.* Resistant sporangia in abundance, with the characteristic cluster of globules and the papilla just formed, were added to water with small tomatoes, or alternatively, swarmers, just liberated in hundreds, were added.

After two days the characteristic pustules could already be detected by the naked eye, indicating the presence of colonies of mature plants. These plants liberated swarmers which did not fuse. Assuming that there was, as in *Allomyces*, a gametophyte generation, it became clear that already the sporophyte had formed, so one looked earlier.

Germlings were sought and found as early as twelve hours after the swarmers were introduced into water with the tomatoes.

It was impossible to see anything on the living skin after less than one day, but when the epidermis was peeled off, fixed in 4 % formalin, stained in cotton blue and examined closely under high magnification tiny plants were found "rooted" in a cuticular crack or an old hair base. A scraping of the skin, similarly treated, revealed them but not *in situ*.

These tiny plants were of two kinds:

(*A*) solitary, small flat thalli, dichotomous, with blunt sporangia often already emptied, and the body of the thallus nearly always empty (Fig. 5);

(*B*) groups of germlings, often eight in a group, either very young and still uninucleate or older (Fig. 6).

In both (*A*) and (*B*) the rhizoidal part of the thallus was extensively developed within the mesocarp of the tomato.

The relation between these two types of growth was difficult to interpret. They both appeared very soon after the germination of the resistant sporangia. The resistant sporangia would liberate swarmers about twelve hours after emission in water; groups of germlings have been found eighteen hours later; solitary thalli have been found twelve hours later. But these latter are difficult to find, except when resistant sporangia are germinating in abundance. It is highly probable that the solitary thallus (*A*) precedes the group (*B*). Fig. 5 (inset) is very suggestive of this. Here is an empty flat thallus in an old hair base and on the same exposed cellulose wall is a group of germlings. Have these come from a sporangium of the flat thallus, for this might give several groups within an hour? It is significant that on tomato skins where such groups have been found there are wide areas bearing nothing at all.

(2) *Dwarf plants in slide cultures.* It was later discovered that swarmers would germinate and grow to maturity with a minimum of oxygen under a coverslip. These were nourished and kept moist by a ring of corn meal agar around the coverslip. The oxygen available was in solution in the water film, and so scarce that infusoria could not live in it. The thallus formed under such conditions is *minute*. The mature dwarf plant retains the size and form of a germling, and produces the first sporangium so soon as the branched rhizoidal hypha has developed and "rooted" it in some morsel of vegetable matter. The sporangium emits four or eight swarmers which have never been seen to fuse (Fig. 7).

As a result of interrupted emission of swarmers from resistant sporangia in slide cultures (due to temporary lack of water, and possibly of encystment of swarmers), such dwarf individuals have been

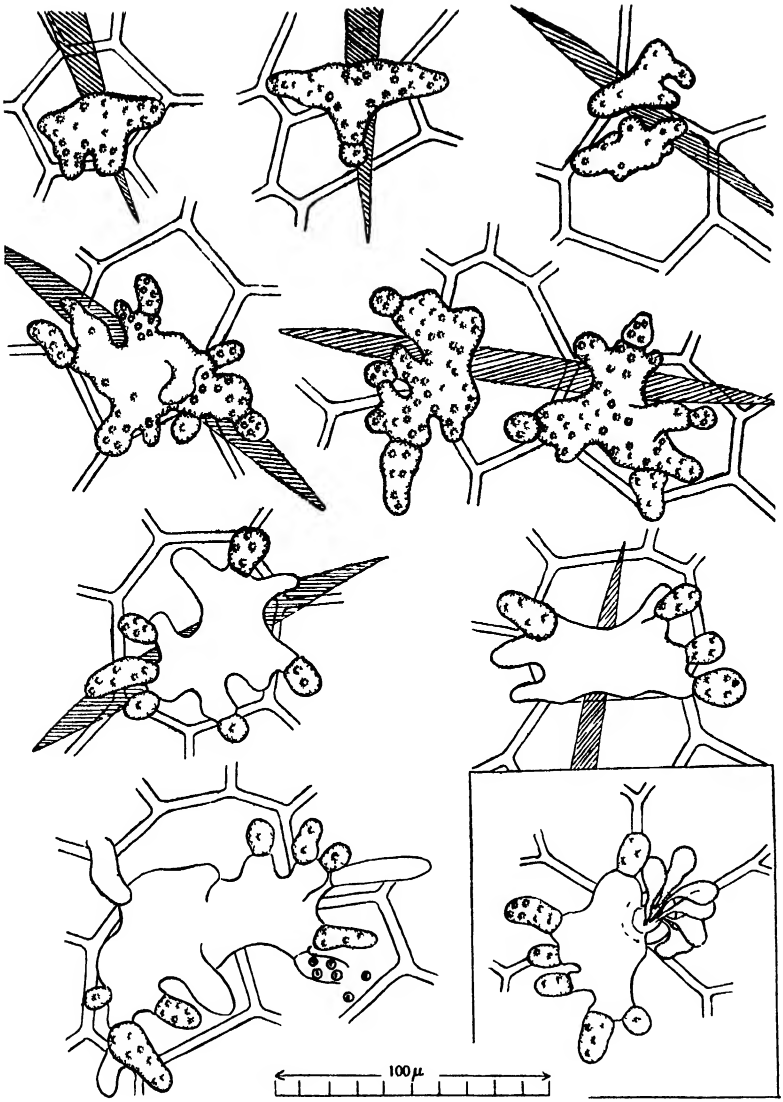
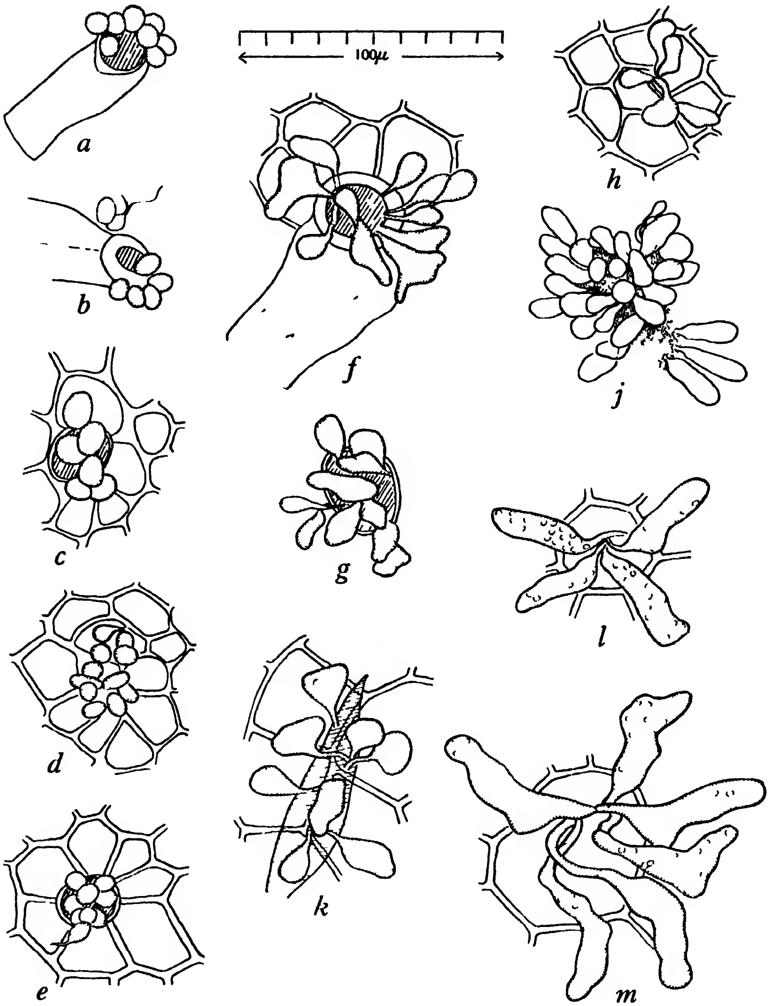


Fig. 5. Solitary flat thalli—not more than two days old and not as large as an epidermal cell of the tomato on which they were growing—found established, 19 September 1938, in a cuticular crack of the epidermis. Three of them, rather older than the rest, have evacuated their protoplasm into the sporangia, leaving the body of the thallus empty in characteristic fashion. (Groups of germlings as shown in Fig. 6 were present elsewhere on the surface of the same tomato.) *Inset.* A similar solitary thallus—not more than two days old—found established, 4 November 1938, in an old hair-base, and, with it, a group of six germlings (cf Fig. 6), possibly from one of its sporangia.



. 6. Groups of germlings, less in size than the epidermal cells of the tomato on which they were found growing. (*a*)–(*e*) 15 October 1938. Five groups found—eighteen hours after stored resistant sporangia emitted swarmers—established in the base of a dead epidermal hair (wall of the hair shown in (*a*) and (*b*)). (*f*), (*g*) 4 November 1938. Two groups of older germlings found—not more than forty-eight hours after the stored resistant sporangia were dropped into water with a tomato—established in the base of a dead epidermal hair (wall of hair shown in (*f*)). (*h*), (*j*) 14 February 1939. Two groups found within sixty hours after stored resistant sporangia were dropped into the water with a tomato. Group (*j*) is in a bed of bacteria. (*k*) 2 November 1938. A group of eight germlings found—within twenty-four hours of putting soaked resistant sporangia into water with a tomato—established in a crack in the cuticle of the tomato epidermis. (*l*), (*m*) 6 October 1938. Two groups of older germlings (crack in cuticle not shown).

found at the mouth of the resistant sporangium and even within the wall (Fig. 8).

(3) *Plants on agar in pure culture.* Dr Ralph Emerson who had become interested in the work in progress, later applied his delicate

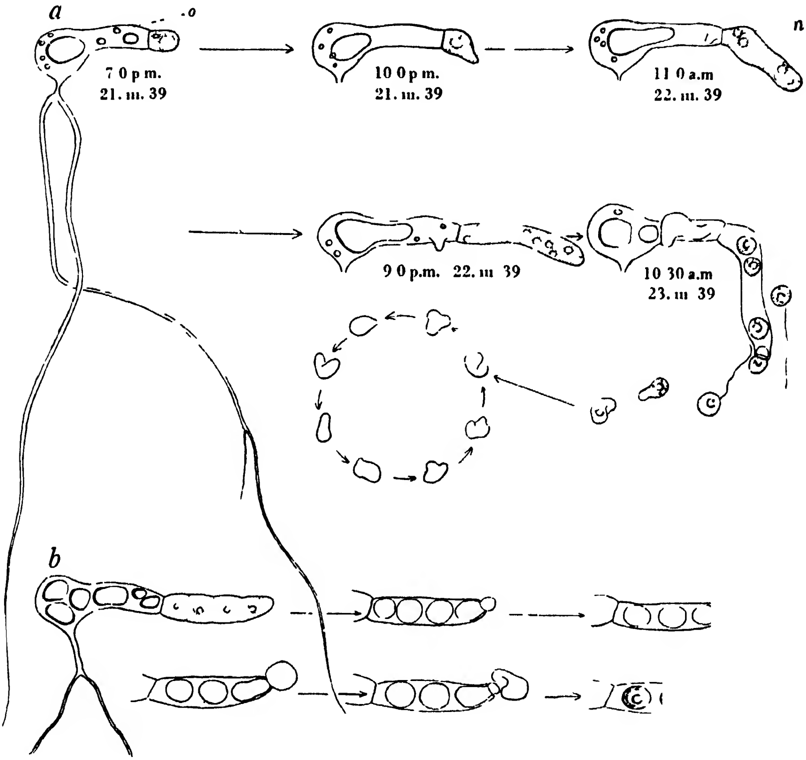


Fig. 7. (*a*) Five stages in growth of a plant derived from a swarmer from a resistant sporangium, and kept under observation under a coverslip from 7.0 p.m. 21 March 1939 to 10.30 a.m. 23 March 1939 by which time it had produced a sporangium with *eight* swarmers, and a second sporangium initial. The swarmers were liberated and became amoeboid. (*b*) Six stages in the development of a similar plant bearing one sporangium with *four* swarmers. *o*, oil globule; *n*, nucleus. Magnification as in Fig. 8.

technique for isolating swarmers, to this material. From an isolated resistant sporangium, just germinating, he isolated the swarmers and germinated them on corn meal agar in Petri dishes. They gave thalli with a profuse rhizoidal region and sporangium-bearing axes of the globose type with one or two dichotomies (Fig. 9). The swarmers

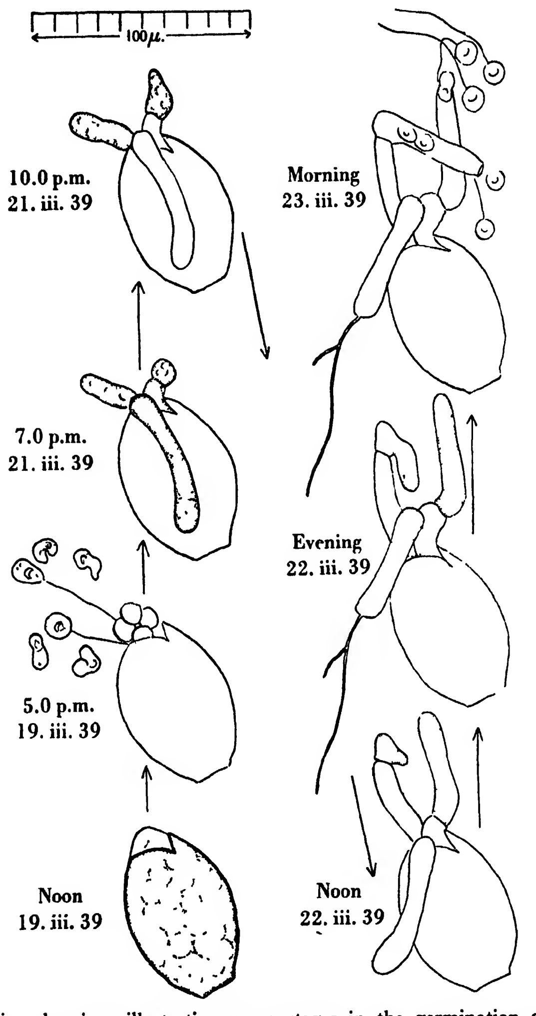


Fig. 8. Outline drawings illustrating seven stages in the germination of a resistant sporangium kept under observation under a coverslip from noon 19 March 1939 to morning 23 March 1939. The last three swarmers to emerge encysted at the mouth of the sporangium and later germinated there, each forming a sporangium and liberating four spores.

emitted by the sporangia of these plants were watched and fusion was never observed. The swarmers settled down and germinated, giving specimens not unlike the parents.

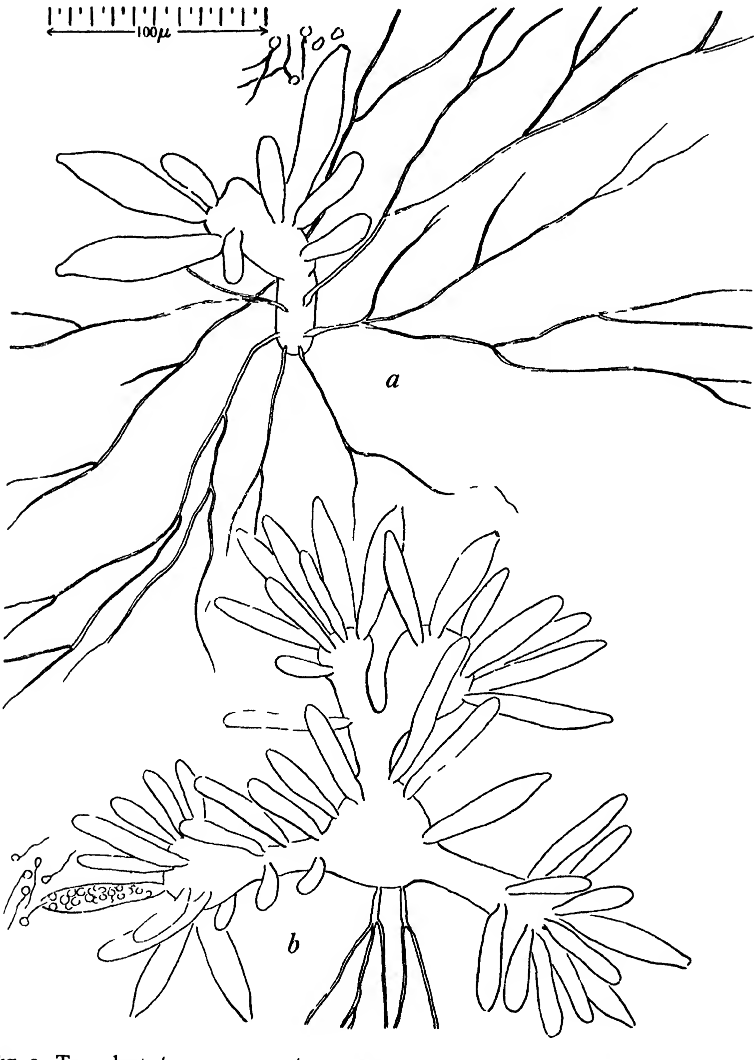


Fig. 9. Two plants from swarmers from resistant sporangia grown on sterile corn meal agar, 28 March 1939. (*a*) 30 March 1939. A two-day old thallus (seen from the side). One sporangium had emitted swarmers, which became germlings within an hour. (*b*) 4 April 1939. A seven-day old thallus (seen from above). Only the base of the very extensive rhizoidal system is here shown.

Conclusion

Gametes, if gametes there be, in *Blastocladia* have yet to be demonstrated. So far, one type of life cycle has been demonstrated involving no alternation of generations. It corresponds to the short cycle of Emerson's (1939) sub-genus *Brachyallomyces*, and Matthews's (1937) *Blastocladiella simplex*.

The thallus that develops from the resistant sporangium swarmer is variable and extremely accommodating, however, and it may yet be shown that it can, under certain conditions, produce gametes.

Summary

Although *Blastocladia Pringsheimii* has been known much longer than any species of *Allomyces* and *Blastocladiella*, its life-history has so far eluded discovery. This is partly due to the difficulty of inducing the resistant sporangia to germinate in culture.

A description of the mature resistant sporangium is given, especially of the structure of the thickened, pitted wall.

Resistant sporangia have now been successfully germinated on many occasions by ensuring first that they were fully mature. Practical hints are given for the encouragement and control of germination.

Phenomena of germination are described and illustrated: the cracking of the thick wall, the development of a papilla, the formation and emission of swarmers.

The fate of the swarmer is followed and its direct germination into a germling of characteristic form is described.

Germlings have been cultivated (*a*) on tomatoes in water, (*b*) in slide cultures, (*c*) on agar plates, and the mature thalli formed in these three types of culture shown to be quite different in form but always to liberate swarmers which have not fused but have germinated directly into groups of plants—the characteristic "pustule".

The life cycle here described corresponds with the short cycle of Emerson's sub-genus *Brachyallomyces* and Matthews's *Blastocladiella simplex*.

It is not suggested that another type of life cycle is impossible. *Blastocladia Pringsheimii* has shown itself to be of so variable a form both in nature and in culture, that it may well be variable also in its life cycle.

It is my pleasant duty to acknowledge the useful criticism and practical help generously given by Miss Grace Waterhouse and Dr Ralph Emerson towards the close of this investigation, and to thank Mrs Edmund Mason for kind help with the drawings.

APPENDIX

Tomatoes were chosen as "bait" for various reasons:

1. The epidermis is colourless.
2. The epidermis is easily torn off clean.
3. Minute cracks form in the cuticle when the tomato is lying in water, and the flagellum of swarmers is caught in the crack. The cellulose is here exposed.
4. There are old hair bases which likewise catch swarmers and offer exposed cellulose within.
5. The rhizoidal hypha of the germling readily penetrates the cellulose of the epidermal wall, thus exposed. (It has been observed that germlings do not settle on unhealthy tomatoes, with broken cell surfaces and they are slow to attack unripe tomatoes.)
6. Tomato skin is extraordinarily resistant. It remains in excellent condition in water for years.
7. When peeled off, the epidermis can be mounted conveniently,
   (*a*) outside up, to show the sporangium-bearing part of the thallus;
   (*b*) inside up, to show the rhizoidal part of the thallus.
8. The epidermis does not stain and remains as a yellow or colourless background to the artificially coloured germlings and plants.
9. Although epidermal cells vary in size in different varieties of tomato they are often useful in comparing size of germlings and grown plants.

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SOME FUNGI ISOLATED FROM PINEWOOD SOIL

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(With 1 Text-figure)

Attempts at the isolation of fungi from the soil began with the work of Adametz (1886), the earliest systematic account being that of Oudemans & Koning (1902). Since that time, many systematic studies of the soil flora have been made in many parts of the world, and the occurrence of a characteristic fungous flora of the soil has been established. Waksman (1932) gives an up-to-date review of the subject, while later papers by various authors have extended the list of reported genera and species.

The constitution of the fungous flora varies considerably with the type of soil concerned, i.e. its structure, the abundance of organic matter, the reaction, the moisture content, etc., and with external conditions such as temperature. For example *Trichoderma* spp. are usually abundant in forest, heath, and other acid soils, while members of the Mucorales appear to preponderate in field and garden soils; Fusaria are typical of cultivated soils, and appear to be rare in virgin soils; Aspergilli characterize greenhouse soils and the soils of warm countries, while Mucorales and Penicillia are typical of the soils of colder climates. Certain genera and species have been isolated repeatedly from cultivated and virgin soils of all types, the commonest genera being *Mucor*, *Zygorhyncus*, *Rhizopus*, *Absidia*, *Penicillium*, *Aspergillus*, *Trichoderma* and *Fusarium*. It is also known that fungi occur to a depth of several feet in the soil (*Zygorhyncus Vuilleminii* and *Trichoderma Koningi* have been found at a depth of six feet), though the surface layer of six to eight inches is the most thickly populated. Bisby, Timonin & James (1935) investigating the fungi of different soil profiles in Manitoba, found that "high temperature fungi" (i.e. those which developed in plates incubated at 37° C.) notably Aspergilli and Trichodermae, predominated in surface soils, while "low temperature fungi" (developing in plates incubated at 6° C.), e.g. *Cylindrocarpon*, members of the Mucorales, and certain Penicillia, showed a great increase in numbers, relative to the total number of fungi present, with greater depth.

Quantitative studies have shown that the greatest numbers of fungi, present as actual mycelium in the soil, occur in acid soils rich in organic matter. Jensen (1931), however, examining a large

number of Danish soils of different types, found no close correlation between fungus numbers and soil type, except that heavy clay soils are poor in fungi. Nor did he find any close correlation between fungus numbers and soil reaction, though the ratio Number of Fungi : Number of Bacteria and Actinomycetes showed a very close relation to the reaction.

He found that fertilizers increased the numbers of fungi in the soil, also the addition of cellulose to the soil stimulated the development of fungi (except Mucorales) in both acid and alkaline soils, while the addition of glucose, casein, or alfalfa seed meal caused an increase of fungi in acid soil, but had less effect in alkaline soil. The number of fungi in the soil, therefore, would appear to depend primarily upon the amount of available food material, but also upon other factors.

The most extensive accounts of fungi isolated from the soil in Great Britain are those of Dale (1912, 1914) and of Bayliss Elliott (1930). Dale isolated and described fungi from sandy, chalky and peat soils, while Bayliss Elliott described the fungi of a salt marsh. The latter has also described, in 1933, some fungi isolated from heath soil. ✓

So far as I am aware, very few studies of the fungi of pinewood soils have been made, though in various accounts of particular groups, especially of the Mucorales, species isolated from pinewood soil have been described. Hagem (1908) has described the Mucorales of a Norwegian pine forest; Rostrup (see Müller *et al.* 1910) isolated species of *Penicillium*, *Trichoderma*, *Mucor*, *Monilia*, *Oidium*, *Dematium*, *Hormodendron*, *Fusicola*, *Fusicladium*, *Citromyces*, *Pachybasium*, *Verticillium* and *Stysanus*, and four sterile mycelia, from heath soils planted with pine trees.

Species of *Trichoderma* and of *Zygorhynchus*, and *Mucor Rammanianus* appear to be particularly characteristic of acid forest soils, especially pinewood soils.

Methods

In the present work, samples of soil were collected in early autumn from a small wood, comprised mainly of *Pinus sylvestris*, a few miles from Nottingham. The surface layer of pine-needles and débris was first scraped away, and a small pit about a foot deep dug with a sterile trowel. Samples were taken from the side of the pit, at four inches and ten inches depth, sterile spatulas being used to transfer the samples to sterile containers, which were then sealed and transferred to the laboratory. At the same time, the reaction of the soil solution was tested, and was found to be *p*H 4·0.

The following media were used for isolation:

(1) Soil extract agar, prepared by boiling 1 kg. soil with 2 litres of water for 1½ hours, filtering, and bringing the reaction of the filtrate to *p*H 4·0, by the addition of normal H_2SO_4, before adding 2 % agar-agar.

(2) Waksman's glucose-peptone agar, consisting of glucose 10 g., peptone 5 g., $MgSO_4.7H_2O$ 0·5 g., water 1 litre. Enough normal H_2SO_4 is added to bring the reaction approximately to *p*H 3·8, and 2 % agar-agar is finally added before sterilization. The final reaction, after sterilization, is *p*H 4·0.

The media used for study and identification included Czapek's agar, 2 % malt-extract agar, potato-mush agar, cornmeal agar, bread, etc.

Two methods of isolation were used. In one, fragments of soil were placed directly upon the medium, and isolations were made after twenty-four hours of incubation at 22° C. This is the "direct method" advocated by Waksman for the isolation of fungi occurring as mycelium in the soil. In the second, samples weighing approximately 10 g. were shaken up with 100 c.c. sterile water, and plates inoculated with drops of the suspension. These plates were incubated at 22° C. for ten days, isolations being made as new colonies appeared, thus allowing fungi which may have been present only as spores in the soil to develop.

Account of fungi isolated

All the fungi enumerated below appeared repeatedly in different plates, and may be assumed to be characteristic of the soil under examination. A number of species which appeared only once or twice have not been included. In all, twenty-one species, belonging to eleven genera, were isolated and identified, also a sterile mycelium.

There seemed to be no appreciable difference in numbers of fungi between the two samples taken at different depths, plates inoculated with sample B (ten inches depth) by the indirect method showing about the same number as those inoculated with sample A. (A careful quantitative study was not made.) The same species appeared in plates made from both samples.

The only fungi isolated by the direct method were *Trichoderma* spp., *Botrytis cinerea*, and members of the Mucorales, the first-named being markedly predominant. Penicillia and an *Aspergillus*, which appeared in plates inoculated by the indirect method, appeared also in the directly-inoculated plates after several days' incubation. The delay in their appearance may well have been due to their slower growth being masked by the rapidly-growing species of *Mucor* and *Trichoderma* during the first twenty-four hours of incubation, rather than to the fact that they were present only as spores and not as mycelium in the soil. It is of interest to note that Jensen states that "the direct isolation method yielded mainly Trichodermae from forest, moor and heath soils, and mainly Mucoraceae from field, garden and salt marsh soils".

The following lists give the species found in the two samples by the different methods of inoculation.

Direct method of isolation

Sample A	Sample B
Botrytis cinerea Pers.	*Botrytis cinerea* Pers.
Mortierella hygrophila Linneman	*Mortierella hygrophila* Linneman
Mucor hiemalis Wehm.	*Mortierella gemmifera* nov. sp.
? *Mucor sylvaticus* Hagem	*Mucor hiemalis* Wehm.
Rhizopus nigricans Ehrenb.	? *Mucor sylvaticus* Hagem
Trichoderma Koningi Oud.	*Rhizopus nigricans* Ehrenb.
Trichoderma lignorum (Tode) Harz	*Trichoderma Koningi* Oud.
Zygorhyncus Moëlleri Vuill.	*Trichoderma lignorum* (Tode) Harz
	Zygorhyncus Moëlleri Vuill.

A sterile mycelium appeared in plates inoculated from both samples, but only after two or three days' incubation.

Indirect method of isolation (both samples)

In addition to the species listed above, the following were found:

Absidia spinosa Lendn.
Acrostalagmus cinnabarinus Corda
Alternaria tenuis Nees
Aspergillus Sydowi Bain. & Sartory (sample A only)
Mucor Rammanianus Moëller
Penicillium cyclopeum Westling (sample B only)
Penicillium spp. (Isolates 12, 13, 16, 17, 18)
Trichoderma album Preuss

Description of species

I. Fungi Imperfecti. *Acrostalagmus cinnabarinus* and *Alternaria tenuis* appeared in about a dozen plates inoculated from each sample by the indirect method, but neither species grew within twenty-four hours in plates inoculated by the direct method. Both have previously been reported from soil. The *Botrytis cinerea* strain appeared in about half the "direct method" plates, and in nearly every plate inoculated by the indirect method, and seems to be characteristic of this soil.

The green *Trichoderma* spp., however, were by far the most abundant, occurring in every plate and overgrowing the cultures so rapidly that it became difficult to isolate the other fungi present. A number of strains were isolated, but all of them fell distinctly into one or other of the two species *T. lignorum* and *T. Koningi*, differing only very slightly in colour and spore size. All the strains referable to *T. lignorum*, when grown on Czapek's agar or glucose-peptone agar, show a strong tendency to submerged growth, with a rather sparse, cobwebby, white aerial mycelium. On malt-extract agar the aerial mycelium is more strongly developed. Small tufts of conidiophores appear after about three days' growth, and become green as the conidia develop. These tufts may appear first at the centre of the

colony, or may not be formed until the mycelium reaches the edge of the dish, when a peripheral zone of tufts appears. In some strains the tufts are more or less uniformly scattered over the surface of the colony, while in others, especially on glucose-peptone agar, there is a distinct tendency to zonation. The bright green colour of the colony darkens with age. The dichotomously branching (occasionally trichotomous) conidiophores bear heads of about fifteen globose, bright green conidia, average diameter $2 \cdot 8\mu$. (One strain has slightly larger conidia, diameter $3 \cdot 0$–$3 \cdot 5\mu$.) On pieces of sterile pinewood the fungus spreads rapidly, conidia appearing in four to five days, and after fourteen days the wood is covered with dark green, powdery growth.

The mycelium of the strains of *T. Koningi* resembles that of *T. lignorum* at first. After seven to eight days' growth dense tufts of conidiophores appear. These tufts are large and cushion-like, often 2–3 mm. diameter, and at first are separated by areas of more or less sterile mycelium. Later, as they become more numerous and increase in size, they become aggregated together and the culture becomes more uniform in appearance. They are bright green, and do not darken much with age. The conidial heads resemble those of *T. lignorum*, but the conidia are ellipsoid, average size $2 \cdot 5 \times 3 \cdot 5\mu$, and are much less deeply coloured when seen under the microscope.

On wood the growth is slower than that of *T. lignorum*, a few tufts of conidiophores appearing in about ten days.

A white *Trichoderma* was isolated about twelve times from samples A and B, by the indirect method. The mycelium resembles the green *Trichoderma* spp. in mode of growth, but is more delicate. After about seven days, white, sparsely distributed, conidial tufts, appear. These tufts consist of branching conidiophores, resembling those of the other species of *Trichoderma*, interspersed with single, spirally-twisted, septate hairs which project beyond the surface of the tuft. The conidia are colourless, globose and small, average diameter $2 \cdot 0\mu$ (rarely elliptical $2 \times 3\mu$). The size and form of the conidia, and the characteristic hairs, suggest that this fungus is the *T. album* described by Preuss (1851). Dale (1912) isolated a white *Trichoderma* which she described under the name of *T. album* Preuss, but in her strain the spores were usually triangular, and the characteristic hairs described by Preuss were absent. Jensen (1931) reports, but does not describe, a *Trichoderma album* from a Danish soil, and other investigators have also reported the occurrence of white forms in various soils.*

II. Aspergilli and Penicillia. The only *Aspergillus* found in any of the plates was *A. Sydowi*, which appeared four or five times in plates from sample A only. It can hardly be regarded as characteristic of

* *Trichoderma*, when kept in culture for several months appears to have a tendency to lose its power of sporulation.

this soil. A strain of *Penicillium cyclopeum* Westling was found in sample B only, and was not frequent. It showed very marked coremium formation on malt extract agar and on bread.

Five other strains of *Penicillium* were isolated repeatedly from both soil samples by the indirect method (isolates 12, 13, 16, 17 and 18).

Penicillium (no. 13) is a member of the group Monoverticillata stricta-floccosa, with smooth, globose conidia 2·0–2·5 μ in diameter. This strain closely resembles *P. restrictum* Gillman & Abbott, but differs in having smooth conidia.

Penicillium (no. 16) is a member of the group Biverticillata-symmetrica, and appears to belong to the *P. luteum* series. The conidiophores have an average diameter of 2·4 μ, bearing metulae 8–9 μ long and sterigmata 6–8 μ long. The conidia are smooth, oval, 1·8–2·5 μ in diameter.

The remaining three Penicillia (nos. 12, 17, 18) are members of the *P. Pfefferianum* series, closely allied to *P. spinulosum* and differing from each other chiefly in colour. No. 12 has divergent chains of globose, faintly spinulose conidia of average diameter 3·0 μ. In no. 17 the chains of conidia tend to adhere in columns, while the conidia themselves resemble in size and form those of no. 12. No. 18 has divergent chains of spinulose conidia, globose or rarely elliptical, from 2 μ diameter to 3·6 × 4·3 μ.

Table I

Isolate	Conidial areas	Reverse
Penicillium no. 12	Tea-green XLVII 25'''' *f*, later deep greyish olive XLVI 21'''' *i*	Light olive-grey LI 23'''' *d*, later cinnamon drab XLVI 13''''
Penicillium no. 13	Glaucous XLVIII 37'''' *f* to dawn grey LII 35''''' *d*	Creamy
Penicillium no. 16	Asphodel-green XLI 29''' to pois-green XLI 29''' *i*	Primrose-yellow XXX 23'' *d*
Penicillium no. 17	Russian green XLII 37''' *i*, later slate-olive XLVII 29'''' *i*	Light pinkish cinnamon XXIX 15'' *d*, later mikado brown XXIX 13'' *i* to chocolate XXVIII 7'' *m*
Penicillium no. 18	Dusky blue-green XXXIII 39'' *m*	Primuline yellow XVI 19'
Penicillium no. 19	Deep bluish grey-green XLII 41''' *i*	Pinkish buff XXIX 17'' *d*, later snuff brown XXIX 15''

III. Mucorales. Four members of the Mucorales isolated were readily identified as *Mucor Rammanianus* Moell., *Zygorhyncus Moelleri* Vuill., *Absidia spinosa* Lendn., and *Rhizopus nigricans* Ehrenb.

Only the (+) strain of the *Rhizopus* was found. The *Absidia* and *M. Rammanianus* occurred several times in plates inoculated by the indirect method from both samples, but were not obtained by the direct

method. Jensen also failed to obtain *M. Rammanianus* by the direct method, for it grows slowly and is quickly overrun by other Mucors and by the Trichodermae, but it appears to be a characteristic member of the flora of pinewood soil.

The remaining two species of *Mucor* (isolates nos. 3 and 6) do not correspond exactly with the descriptions of any known species, but agree sufficiently closely with *M. sylvaticus* Hagem and *M. hiemalis* Wehm. to be regarded as strains of these species.

Mucor no. 3 most nearly resembles *M. sylvaticus*, a species found by Hagem in pine forest soil in Norway, differing from it chiefly in the smaller size of the sporangia and the greater average size of the spores. It forms on bread a white turf 1·5–2 cm. in height, turning greyish with age. The sporangiophores, of average diameter 6·5 μ, show sparse cymose branching. (Lendner describes the branching of *M. sylvaticus* as racemose, Hagem as cymose.) The sporangia are 25–60 μ, mostly 30 μ diameter (*M. sylvaticus* Hagem has sporangia 45–70 μ in diameter; Lendner states that the average diameter is 44 μ, rather larger than the sporangia of the strain here described), membrane diffluent leaving a collarette, columella oval to spherical $7 \times 10\,\mu$ to $25 \times 30\,\mu$.

Spores sometimes round, more often oval or elliptical, average size $5 \times 6{\cdot}6\,\mu$ (Hagem describes the spores of *M. sylvaticus* as shortly cylindrical with rounded ends, $2{\cdot}5$–$3{\cdot}5 \times 3{\cdot}5$–$5\,\mu$, Lendner as oval or subcylindrical, very unequal in size, $2 \times 4\,\mu$ to $3 \times 5\,\mu$, Zycha (1935) as oval or cylindrical, $2{\cdot}5$–$3{\cdot}5 \times 4$–$5\,\mu$, sometimes as large as $4{\cdot}5 \times 7\,\mu$.) Chlamydospores are produced in the submerged mycelium, and are spherical, smooth-walled, 6·5–23 μ diameter. Numerous azygospores with encrusted membranes, 30–70 μ in diameter, are produced, frequently in pairs.

Mucor no. 6 appears to be a strain of *M. hiemalis* Wehm. It forms on bread a yellowish white turf about 1·5 cm. high. The sporangiophores are most frequently simple, but occasionally show racemose branching. Sporangia 18–60 μ diameter, mostly about 45 μ (rather smaller than those of typical *M. hiemalis*). Membrane diffluent, leaving a collarette. Columella oval, average size $18 \times 21\,\mu$. Spores mostly elliptical, and very variable in size, from $3 \times 4{\cdot}5\,\mu$ to $6 \times 10{\cdot}5\,\mu$. Chlamydospores produced occasionally, spherical or oval, 16–27 μ in diameter. When plated out with (+) and (−) strains of *M. hiemalis* Wehm., this strain reacts with the (−) strain producing normal zygospores.

Of the two *Mortierella* spp. isolated, one agrees very closely with the description of *M. hygrophila* Linneman, differing chiefly in the smaller size of the spores. This species was found by Linneman (1936) in pinewood and other soils, and in cultures of aquatic fungi. According to her description, the submerged mycelium, in culture on solid

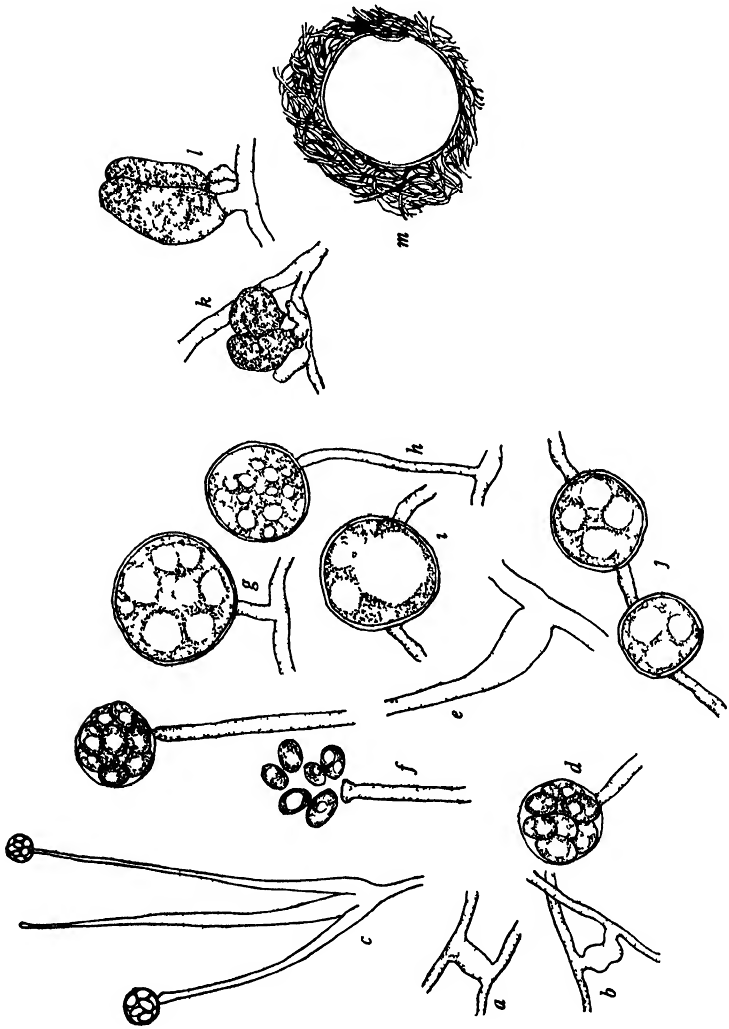

Fig. 1. *Mortierella gemmifera* *a*, *b*, vegetative anastomoses; *c*, *d*, *e*, sporangia; *f*, dehisced sporangium; *g*, *h*, terminal gemmae; *i*, *j*, intercalary gemmae; *k*, *l*, early stages in zygospore formation; *m*, mature zygospore with part of hyphal sheath

a, *b* × 250, *c*–*l* × 500, *m* × 125

media, forms broad, distinct zones or patches. The pure white aerial mycelium, which reaches a height of 1·5 cm., is richly branched and forms flocculent columns or a dense homogeneous mass.

The sporangiophores arise from stolon-like hyphae, and branch cymosely, the branches diverging at an angle of 45°. There may be as many as twenty branches, and cross-walls may be formed. Branching is especially profuse in water-culture. The sporangiophores may be up to 1 mm. long, usually 200–400 μ, but are sometimes small, thin and fragile. Columella only slightly arched, membrane diffluent leaving a collarette. The strain isolated by me agrees closely with the above description, but while the spores of the typical *M. hygrophila* are described as "irregular, round or oval, with a central oil drop, 8–25 μ diameter, mostly 16 μ", those of the strain in question are mostly oval, and measure 6–8 μ to $12 \times 14\,\mu$, rarely attaining a diameter of 16 μ. The number of spores in the sporangium varies greatly. Elongated chlamydospores, variable in size and shape, are found in old cultures.

The second *Mortierella* does not correspond with any species hitherto described. On bread a dense, cottony white turf about 1·5 cm. high is formed, while on malt-extract agar and similar media there is a tendency to submerged growth with irregular tufts and patches of aerial mycelium. Sporangiophores usually simple but sometimes cymosely branched, 100–300 μ long, tapering from 10–25 μ diameter at the base to 5–8 μ at the apex. There is sometimes, but not always, a constriction below the sporangium resembling that in *M. strangulata* van Tiegh. Sporangia are not abundant. They are spherical, 20–30 μ in diameter, with a diffluent membrane. No basal collarette appears to be left. Spores elliptical, average size $10 \times 12\,\mu$. Zygospores rather sparsely produced on malt agar, more abundant on corn meal agar and Czapek's agar, colourless, smooth-walled, 100–150 μ diameter. A thick hyphal sheath gives a total diameter of 0·5 mm. or more. A very characteristic feature is the production of numerous spherical, smooth-walled gemmae, 35–50 μ in diameter, which are particularly abundant on malt agar. They are borne either on short, slender, erect branches of the mycelium (resembling, apart from their smooth walls, the stylospores of other species of *Mortierella*) or in intercalary positions on the submerged mycelium. The name *M. gemmifera* is suggested by this characteristic.

Diagnosis. Mortierella gemmifera sp. nov. Mycelio denso, albido; hyphis sporangiferis interdum cymose ramosis, sed plerumque simplicibus, 100–300 μ altis, versus apicem sensim attenuatis ab 10–25 μ ad 5–8 μ diam.; sporangis pallidis, globosis, 20–30 μ diam.; cuticulo diffluente, collari basilari haud persistente; sporis ellipsoidiis $10 \times 12\,\mu$ diam. Zygosporis in "malt agar" et "cornmeal agar" bene evolutis, sphaericis, hyalinis, levibus, 100–150 μ diam., cum vagina hyphali

0·5 mm. Gemmis in "malt agar" optime evolutis, sphaericis, levibus, 35–50μ diam., cum denso protoplasmate et guttulis olei.

IV. The sterile mycelium appeared after several days in plates inoculated directly with soil, and also in several plates inoculated by the indirect method. It consists of fine, branching septate hyphae, and is white at first, later turning yellow. On Czapek's agar the reverse of the colony is at first pale yellow, rapidly becoming deep rose-pink, while on malt agar the reverse changes from yellow to orange. This fungus may be the vegetative mycelium of a Basidiomycete, possibly mycorrhizal.

Summary

Twenty-one species, belonging to eleven genera, were isolated from samples of pinewood soil. *Trichoderma* spp. and *Botrytis cinerea* preponderated, followed by Penicillia and members of the Mucorales.

Most of the species have been found in various soils by other investigators, and may be regarded as characteristic of acid forest soils in temperate climates. There appeared to be little or no difference between samples taken at four-inch and at ten-inch depths, the same species being present in both samples.

A new species of *Mortierella* is described.

Acknowledgements

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A STUDY OF *UROMYCES SCIRPI* BURR.

By MARGARET FORT

(With Plate IV and 11 Text-figures)

Introduction

Uromyces Scirpi Burr. is a heteroecious eu-form. The two stages of its life history were first connected in 1890, when Plowright found that *Aecidium Glaucis* and *Uromyces lineolatus*, infecting *Glaux maritima* and *Scirpus maritimus* respectively, were really part of the same fungus. In 1904, Sydow described the aecidial stage as occurring on *Hippuris* and various Umbellifers, amongst which was *Oenanthe crocata*, as well as on *Glaux maritima*. Grove (1913) described the aecidial stage appearing on *G. maritima*, but quoted Sydow as to the variety of hosts it might affect. In 1934, Grove and Chesters described the occurrence of the aecidial stage on *G. maritima* at Gorleston in Norfolk, though not on supposedly susceptible Umbellifers and *Hippuris vulgaris* which grew nearby, and also the appearance, at Saltash, in Cornwall, of aecidia on *Oenanthe crocata*, but none on *Glaux maritima* which grew in the neighbourhood.

In 1938, aecidia, uredospores and teleutospores, the former on *Oenanthe crocata* and the latter on *Scirpus maritimus* were found at the estuary of the River Eden in Fife. These agreed with the description given in Grove (1913) under *Uromyces Scirpi* Burr. This was the first record of the rust from Scotland (Macdonald, 1939). No infection of the neighbouring *Glaux* was seen. Work on the rust was therefore undertaken to determine the host relationships and to study certain aspects of the life history of the fungus.

Methods

Pieces of *Oenanthe crocata* and *Scirpus maritimus* material were fixed with Ble's fixative, or alcohol-formalin-acetic no. 2 (Rawlins, 1933). Some of the material was imbedded in paraffin, and microtomed at 15μ thick, and some was hand-sectioned. The stains used were Haidenhain's iron-alum-haematoxylin, counterstained with congo red in clove oil. As, however, the congo red did not give good results, iron-alum-haematoxylin was used alone, and found to be very satisfactory. Sections were also stained with alcoholic safranin, and aqueous safranin counterstained with light green in clove oil. Cotton blue in lactic acid was used for mounting some hand-sections as it shows up hyphae very clearly.

Inoculation experiments

Inoculation experiments were begun as soon as teleutospores from *Scirpus*, which had been kept in a tin outside all winter, had begun to germinate.

The time of germination was determined by mounting scrapings from teleutosori in drops of sterile water, on slides placed in Petri dishes, lined with damp filter-paper. This was done in October, January, February, the dishes usually being kept in the laboratory; though on one occasion two were placed outside. It was not till the thirteenth of February that general germination commenced, though one germinating teleutospore was seen in November and several on the ninth of January. Germination in all dishes took place at approximately the same time, whether set up in October, January, or February, whether placed outside or inside. Though there had just been a spell of hard frost, followed by several days mild weather, this would seem to have little bearing on the phenomenon, as some of the material had been artificially frozen in October, by surrounding it with pieces of ice, with no consequent effect on the time of germination. Also some of the teleutospores, i.e. those which were set up in October, had not been subjected to frost, as they were kept in the laboratory.

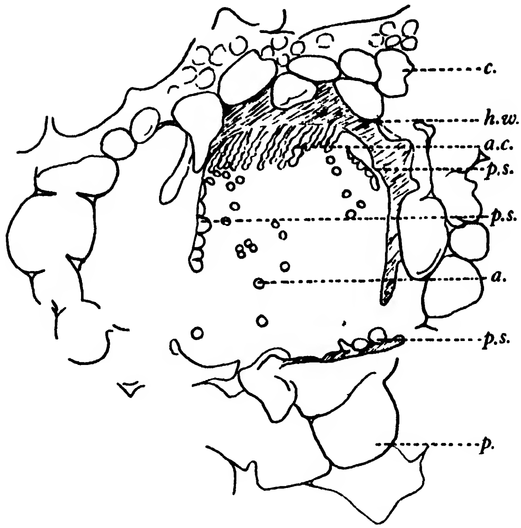
Germinating uredospores were also seen on the thirteenth of February.

Three methods of inoculation were tried. The first consisted of placing a suspension of teleutospores in water on the leaves of a potted *Oenanthe crocata* plant, which had been well-watered. The second consisted of placing pieces of well-soaked teleutospore-bearing material on the surface of the soil of a similar plant. After both these methods the plant was kept under a bell-jar for a day to facilitate the germination of the basidiospores and entrance of mycelium. As these were both unsuccessful they were abandoned in favour of a third, which was that used by Lamb (1935). This method was used principally with teleutospores, and so was used to inoculate *Oenanthe crocata* and *Glaux maritima* plants. The inoculation of the *Glaux* plants was unsuccessful, but that of the *Oenanthe* plants highly successful.

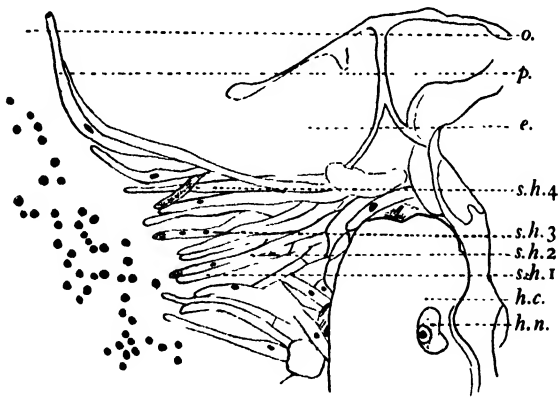
Table I shows the number of experiments done, and the time taken after inoculation for each infection to appear.

Table I. *Infection of* Oenanthe crocata

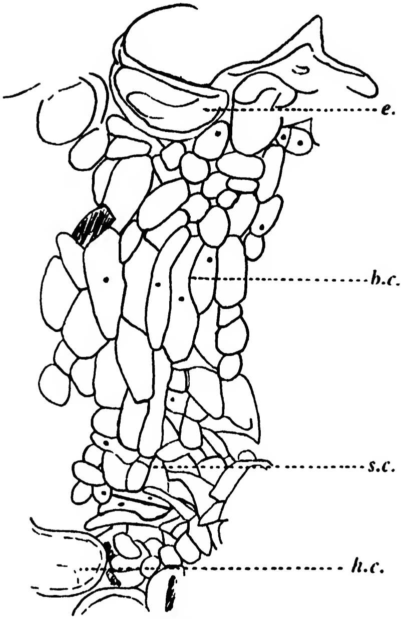
No.	Date of inoculation	Date of infection	Time taken
1	23 February	13 March	18 days
2	10 April	24 April	14 days
3	12 April	24 April	12 days
4	14 April	24 April	10 days
5	20 May	26 May	6 days



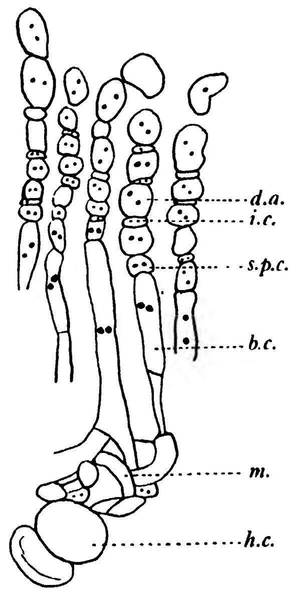
Text-fig. 1. Transverse section of *Oenanthe crocata* petiole with aecidium opening inwards instead of outwards, aecidiospore (*a.*), aecidial chains (*a.c.*), cortex (*c.*), hyphal weft (*h.w.*), pith (*p.*), pseudoperidium (*p.s.*). ×960.



Text-fig. 2. Transverse section part of spermogonium. Epidermal cell (*e.*), host cell (*h.c.*), host nucleus (*h.n.*), ostiole (*o.*), paraphysis (*p.*), spermatial hypha composed of long and smaller cell (*s.h.* 1), spermatial hypha with spore forming at end (*s.h.* 2), spermatial hypha with division of nucleus (*s.h.* 3), spermatial hypha full of cytoplasm (*s.h.* 4). ×790.



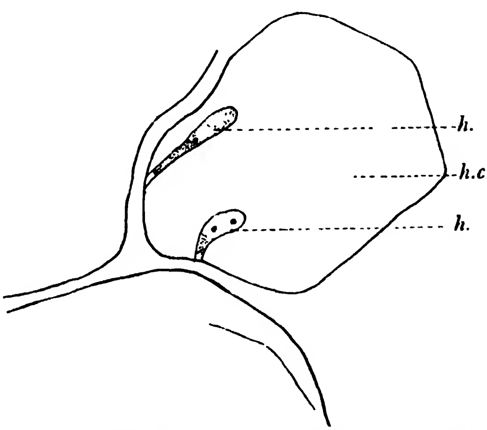
Text-fig 3



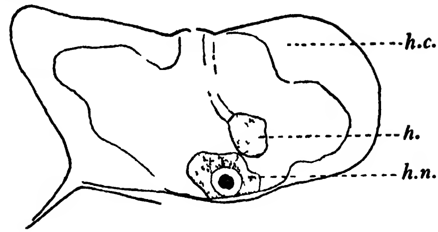
Text-fig 4

Text-fig. 3. Transverse section part of immature aecidium, buffer cells (*b.c.*), epidermis (*e.*), host cell (*h.c.*), sporogenous layer (*s.c.*). ×480.

Text-fig. 4. Aecidial chains, basal or fertile cell (*b.c.*), developing aecidiospore (*d.a.*), intercalary cell (*i.c.*), mycelium (*m.*), spore mother cell (*s.p.c.*), host cell (*h.c.*). ×480.



Text-fig. 5. Host cell (*h.c.*) with haustorium (*h.*). ×960



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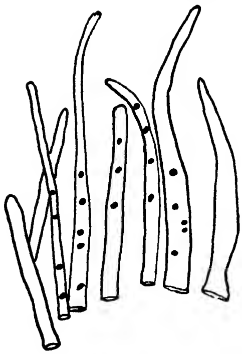

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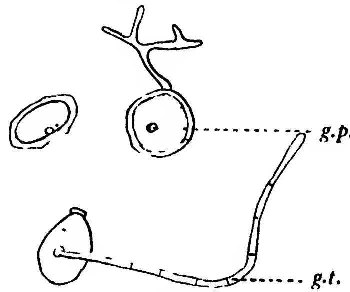

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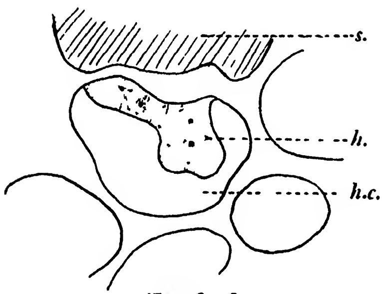
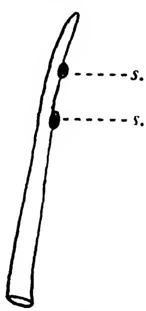
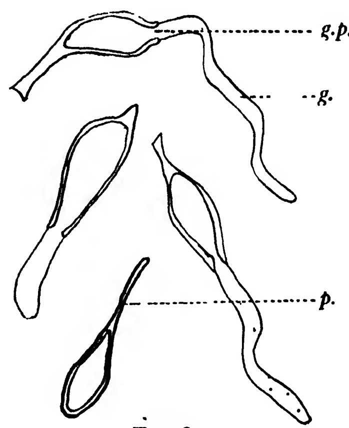


Text-fig. 6



Text-fig. 9



Text-fig. 11

Text-fig. 6. Host cell (*h.c.*) from just under spermogonium (*s.*) showing multinucleate haustorium (*h.*). ×960.
Text-fig. 7. Host cell (*h.c.*) with haustorium (*h.*) near the nucleus (*h.n.*). ×960.
Text-fig. 8. Group of multinucleate paraphyses from ostiole of a spermogonium. ×960.
Text-fig. 9. Paraphysis from the same spermogonium as those in fig. 8 with spermatia (*s.*) attached. ×960.
Text-fig. 10. Uredospores, germ pore (*g.p.*), germ tube (*g.t.*). ×380.
Text-fig. 11. Teleutospores, germ pore (*g.p.*), germ tube (*g.*), pedicel (*p*). ×380.

Infection is marked by a yellowing of the plant tissues, and followed by the appearance of spermogonia. These appeared on the dates given above under "Date of infection" as minute orange dots, and opened the following day, when drops of exudate were distinguished. When viewed from the side the paraphyses can be seen projecting beyond the epidermis. A flower-like odour has been mentioned as emanating from spermogonia but none could be detected here. The spermogonia are produced in patches, usually about seven in a group.

About the twenty-second day the first signs of aecidia are seen, and these open about eight days later. A noticeable feature of their position is that they tend to grow in the furrow of the petiole or on the ridges, and in the leaf, on the veins.

Lamb's method was also used for inoculating *Scirpus* seedlings by means of uredospores, but as these were rather scarce the extra precaution of obtaining them from scrapings from teleutosori and transferring them in a drop of water to the *Scirpus* plant was taken. No infection was obtained from this experiment. Inoculation of *Scirpus* by aecidiospores from *Oenanthe crocata* was done by leaving a *Scirpus* plant in a cool frame where the infected *Oenanthe* plants were kept. Uredosori were first seen on the *Scirpus* plant on 1 June, but no time taken for infection to develop after inoculation can be given as the time of inoculation is uncertain.

General description of rust

The spermogonia and aecidia of the rust occur on the petioles and leaves of *Oenanthe crocata*, as minute dots. The spermogonia are orange, and visible chiefly because of the drop of sticky secretion which they exude. They appear in groups. The aecidia too, are orange, and are cup-shaped, occurring in groups. The tissues round the aecidia tend to be swollen and yellowed. In some places, particularly on a dying leaf, green lines are present round the infected areas. It has been suggested (Rice, 1935) that such lines are due to the fungus actually having a beneficial effect on the host cells, and stimulating the protoplast and hence the chloroplasts.

Spermogonia and aecidia tend to grow on the collenchymatous ridges of the petiole. This is especially noticeable in the former. When not on the ridges they are situated in the furrow on the upper side. The presence in the furrow of spermogonia may be due to the effect of gravity on drops of water present on the plant when inoculated. This is confirmed by the appearance of large infections, where two leaflets meet the petiole in such a way as to present a hollow in which water would be expected to collect.

In transverse section, of the petiole or leaf, the spermogonia appear as flask-shaped structures opening to the outside. In the leaf the

spermogonia, though more frequent on the upper side, are not confined to it, but occur on the lower as well. They have a tendency in the leaf to grow on the veins.

In a transverse section of the petiole the aecidia open to the outside (Pl. IV, fig. 1), as a rule, but occasionally they are found inside the tissues, particularly in the aerenchymatous pith, where they occupy an air space (Pl. IV, fig. 2). One was found growing the normal depth below the epidermis but opening inwards instead of outwards (Text-fig. 1). This would appear to confirm Colley's opinion (1917), that aecidia produced in the pith or cortex are abnormalities with no special morphological significance. A possibility, suggested by the fact that aecidia in the pith open into the air spaces, is that the accidium originated near one of the occasional cortical air spaces and, taking the path of least resistance, opened into it.

Aecidiospore measurements were $20\text{–}28 \times 16\text{–}26\mu$. Grove (1913) gives the following figures: $16\text{–}24 \times 14\text{–}20\mu$.

The uredo- and teleutosori appear on both sides of the leaves, on the leaf sheaths, and the inflorescence stalks of *Scirpus maritimus* as brown streaks. The uredosori are lighter in colour than the teleutosori.

Uredospores are globose to ovate and yellowish brown. The outer coat bears minute protuberances. There are three equatorial germ pores. Spore measurements obtained were $22\text{–}30 \times 18\text{–}21\mu$ ($22\text{–}25 \times 16\text{–}25\mu$ Grove). On germinating they produce a thin-walled germ tube from one of the germ pores. The germ tube soon becomes septate (Text-fig. 10).

Teleutospores are borne in dark brown sori. The spores are pale brown, smooth and club-shaped. They taper above to the apical germ pore. The wall round this is thickened. The pedicels are brownish and persistent. The measurements of these spores are $27\text{–}48 \times 13\text{–}21\mu$ ($26\text{–}45 \times 15\text{–}21\mu$ Grove). On germination the teleutospore produces a hyaline tube from the germ pore at the upper end of the spore (Text-fig. 11). This tube bears sterigmata and basidiospores.

Cytology of the rust

The internal appearance of petioles or leaves of *Oenanthe crocata* is more or less normal in a fairly heavy infection, except for the fungal threads which traverse and often fill the intercellular spaces (Pl. IV, fig. 2). This is especially so in the pith, where air spaces abound, but in a very heavy infection the spaces may be so filled that the individual host cells are isolated in the fungal wefts. These host cells appear quite healthy. Invasion of the host cells takes place by haustoria. As a rule these are simple, allantoid structures full of protoplasm (Text-fig. 5), though a compound one was found at the base of a spermogonium (Text-fig. 6). No effect on the host nucleus

is visible. No sheath was seen round the haustoria (Text-figs. 5–7). The hyphae tend to be irregular in outline and branching. Particularly in the air spaces of the pith they are covered with minute, shining globules. As it has been found that accumulation of starch is a characteristic of infection by some rusts (Gwynne-Vaughan & Barnes, 1937), these were tested for starch but the result was negative.

In preparations where aecidial infection was heavy, large cells were frequently found, elongated at right angles to the epidermis, and giving the appearance of palisade cells. These occurred in the cortex and seemed to take the place of the assimilating cells of a normal petiole. They contained no chloroplasts and occurred where there were several aecidia in close proximity to one another (Pl. IV, fig. 1 and Text-fig. 3). They were not seen where spermogonia were produced. It is probable that these cells, together with large quantities of mycelium, are the cause of the hypertrophy of the host and being free of chlorophyll, account for the yellow appearance of infected areas.

The spermogonium is composed of spermatial hyphae which grow in from the closely intertwined hyphal network which surrounds the spermogonium. The hyphae are thus arranged to form a globose structure, which has a cavity in the centre. Each spermatial hypha consists of a long cell, containing one nucleus (Text-fig. 2). There may be in addition, a small cell at the base of a long one. These long cells, besides containing one nucleus, have varying amounts of cytoplasm, according as the hypha is young or old. In the formation of a spermatium the cytoplasm moves up to the top of the hypha, and the nucleus divides into two, one part moving up to the tip of the spermatial hypha. There a cell wall is formed and the spore is cut off. This spore, the spermatium, is an oval thin-walled body with a large nucleus and very little cytoplasm. The spermatia fill the cavity in the spermogonium, and are carried out of it in a sticky secretion. The origin of this exudate is obscure, but it is here suggested that certain cells which are full of cytoplasm, and interspersed with the spermatial hyphae may form it. The opening of the spermogonium to the outside is small, and is lined with paraphyses, which resemble the spermatial hyphae very closely, but which are sterile. They turn outwards through the ostiole, and project through it in a brush-like tuft, giving the spermogonium its flask-shaped appearance. In some preparations spermogonia were found in which the paraphyses blocked the ostiole, and the exudate was dried on the surface of the leaf. Spermogonia of this type have been considered as dead (Allen, 1933). Spermatia were seen adhering to paraphyses in some spermogonia (Text-fig. 9), but there was no indication whether they were products of that particular spermogonium or of another. Paraphyses were also found with several nuclei, sometimes as many as five being present (Text-fig. 8).

Paraphyses containing many nuclei have been suggested as a possible means of entrance of the spermatia (Allen, 1933).

Apart from the paraphyses, this stage of the fungus was uninucleate.

In some sections, immature aecidia were seen. These were composed of a hyphal weft, the cells of which contain cytoplasm, surmounted by large cells, which are more or less empty, and are called sterile or buffer cells (Text-fig. 3). The function of these cells is thought to be that of crushing the host cells of the cortex, thus making way for the aecidial chains which develop from the sporogenous layer. These aecidia are uninucleate but may have occasional binucleate cells in them. The aecidial primordia originate about five cell-layers below the epidermis.

Mature aecidia are cup-shaped structures. They consist of basipetal chains bearing aecidiospores (Text-fig. 4). Each chain consists of a large elongated cell, the basal or fertile cell, which arises at right angles to the tangential cells of the hyphal weft, and which bears a globular spore mother cell above it. Both the basal cell, and the spore mother cell, are binucleate. Each spore mother cell abstricts aecidiospores, each of which cuts off from its base a small intercalary cell. The intercalary cells, as the aecidiospores attain maturity, degenerate and finally disintegrate. Suggestions of two-legged cells, found in other rusts, were seen here too, but were very occasional. The aecidial chains are enclosed in a pseudoperidium, composed of roundish cells tending to be polygonal, which seem empty, and resemble the aecidiospores in arrangement and size. No intercalary cells were seen associated with them.

The cells of the mycelium on *Scirpus maritimus* are binucleate.

Conclusion

Attempts to produce aecidia of *Uromyces Scirpi* on *Glaux maritima*, by inoculation with teleutospores, failed repeatedly and no natural infections were found though the *Scirpus* and *Glaux* hosts grow close together. On the other hand, aecidia were easily produced on *Oenanthe crocata* by artificial means and are found freely in nature in the same places when *Glaux* remains uninfected. It seems clear, therefore, that *Uromyces Scirpi* is a rust which shows specialization in the aecidial stage and that the form of the rust which occurs on *Oenanthe* will not infect *Glaux maritima*. The presence of germinating uredospores on *Scirpus maritimus*, in the early spring, indicates how it is possible for the aecidial stage to be cut out. Once this break in habit has occurred the chance of the introduction of a new aecidial host must be greatly increased.

Observations made on the rust on *Oenanthe crocata* showed that binucleate cells regularly make their first appearance at the base of the

developing aecidium. The spermogonia normally are uninucleate except for the paraphyses. These are frequently binucleate or multinucleate. Spermatia are often seen adhering to them and fusions apparently occur. Though it is impossible to prove the origin of such spermatia it is probable that some come from other spermogonia and that, after one comes in contact with a paraphysis, its single nucleus passes in. The products of the division of such a nucleus could reach, by migration, the aecidial primordium with its uninucleate cells and there initiate the binucleate phase as, for example, in the manner described for *Puccinia Phragmitis* by Lamb.

Summary

1. All stages of *Uromyces Scirpi* have been found near St Andrews. Uredo- and teleutospores on *Scirpus maritimus*; spermogonia and aecidia on *Oenanthe crocata*. No aecidia were present on *Glaux maritima*.

2. Inoculation experiments repeatedly brought about infection of *Oenanthe* but not of *Glaux*. *Scirpus maritimus* was artificially infected from *Oenanthe crocata*.

3. The mycelium on *Scirpus maritimus* is binucleate, that on *Oenanthe crocata* is uninucleate till after the production of spermatia. Multinucleate spermogonial paraphyses are often found with adhering spermatia. Binucleate cells appear regularly in the base of the developing aecidium and the aecidiospores are binucleate.

4. It is suggested that the aecidia found on *Oenanthe crocata* belong to a different specialized race of *Uromyces Scirpi* from those occurring on *Glaux maritima* elsewhere. Further, that the binucleate condition is due to the migration to the aecidial initials of the products of the nucleus of a spermatium which has fused with and entered one of the spermogonial paraphyses.

The writer wishes to acknowledge the supervision received and the facilities placed at her disposal in the Botany Department of the University, St Andrews.

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EXPLANATION OF PLATE IV

Fig. 1. Transverse section of *Oenanthe crocata* petiole showing three aecidia (*a*) in the furrow, and palisade-like cells (*e.c.*). ×67.

Fig. 2. As in fig. 1, showing internal aecidium (*a*), elongated cells (*e.c.*), hyphal network under the aecidium (*h*), hyphal wefts in air spaces in the pith (*h.w.*). ×67.

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Fig 2

EXAMINATION OF *AECIDIUM LEUCOSPERMUM* D.C. FROM SCOTLAND

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(With 1 Text-figure)

In the Royal Botanic Garden, Edinburgh, there is a patch of *Anemone nemorosa* infected with *Aecidium leucospermum*, which has been there for at least twelve years, but with no sign of other spore stages on the surrounding plants. This species is well known on account of its repeating aecidium, but in the course of four years' observations, the fungus has not been observed to spread to other plants of *Anemone* in the same bed.

Dowson (1912), working on *Aecidium leucospermum* from *Anemone nemorosa* collected near Hamburg, found that the mycelium was perennial in the rhizome, though otherwise quite normal, for the mycelial cells were uninucleate, and the peridial cells and aecidiospores were all binucleate. Kursanow (1917) on the other hand, worked on material from *Anemone ranunculoides* collected in the neighbourhood of Moscow, and found that there were two distinct forms, which grew on separate plants. In the uninucleate form, a relatively large number of aecidiospores (up to 5 %) were binucleate, but in most of these the binucleate condition was secondary, that is to say, an occasional spore in a uninucleate chain was binucleate. There were, however, a few chains in which all the spores were binucleate, and these arose from binucleate basal cells.

The nuclear condition of the Scottish material therefore seemed worth investigation, especially because re-infection of the *Anemone* is almost unknown.

On the Scottish material, spermogonia were produced at the beginning of March, and were fully mature towards the end of the month. They occurred on the upper surface of the leaf, and shrivelled up towards the end of April. The aecidia were first visible to the naked eye about the end of March, and reached maturity a month later. They were plentiful but were at first to be found only on the lower surface of the leaf, though a few were later produced on the upper surface. Neither Dowson nor Kursanow mentioned the spermogonia, though they have been recorded by other investigators.

An examination of the aecidia showed that the spores were uninucleate, with an occasional chain of binucleate spores. Some aecidia had no binucleate chains in them, whilst others had three or even four binucleate chains, and as Kursanow observed, these were distinguishable from the uninucleate ones by their greater height in the earlier stages of development of the aecidium. The binucleate spores can usually be distinguished by their greater size.

On several occasions a binucleate spore was observed, which could not be traced to any binucleate chain, and which appeared to be the terminal spore of a uninucleate chain. One of these spores, which, owing to its size could be described as a mammoth spore, appeared to have originated from the fusion of the terminal cells of two uni-

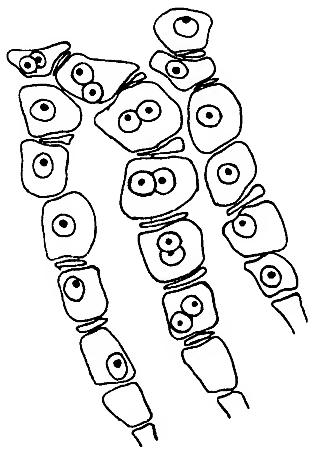

Fig. 1. *Aecidium leucospermum*, chains of aecidiospores. ×440.

nucleate chains. The other binucleate terminal spores apparently did not arise in this way. Kursanow figured a uninucleate chain with a single binucleate spore in the centre. This has also been observed in the Scottish material, though not nearly as frequently as Kursanow states. In the Russian material of *Aecidium leucospermum*, Kursanow stated that the predominant type of binucleate spore was of this latter type, that is, single spores in uninucleate chains. This was not so with the Scottish material however, where whole binucleate chains were the predominant type.

An examination of the peridial cells, showed that they were uninucleate as was to be expected. With regard to the *Anemone* leaves, Grove (1913) stated (p. 331): "The leaves become longer, narrower and of a paler green, and are borne on longer petioles. They are often

divided into more segments than the normal leaves." This was not so in the Edinburgh material. The leaves were smaller and of a paler green, but were certainly not divided into more segments, nor were the petioles longer. Each normal *Anemone* leaf is built up of three leaflets, with two of them usually very deeply cut, making it look like five leaflets. In infected specimens the three leaflets were still produced, but were not nearly so deeply cut, and there were fewer lobes on each segment. The petioles were shorter, or at most as long as those of the uninfected plants surrounding them, though other material of *Aecidium leucospermum* collected in Scotland showed the longer petioles.

Kursanow found that the uninucleate spores germinated readily in a damp chamber, but infection experiments on *Anemone ranunculoides* and *Sorbus Aucuparia* (the alternate host of *Aecidium leucospermum-Ochropsora Ariae* (Fuck.) Ramsb.) all proved negative. Using the Scottish material, infection experiments were carried out on young trees of *Pyrus Malus* (cultivated apple) and *Sorbus Aucuparia*, as well as on mature plants of *Anemone nemorosa* from several sources, but the results were entirely negative. Soppit (1893), however, demonstrated that re-infection of the *Anemone* can be obtained. He expressly stated that his attempts to infect mature plants of *Anemone nemorosa* had been unsuccessful, but on using seedling plants, he obtained aecidia on them in the following spring. The fact that young plants were used has apparently been overlooked by other investigators. It is hoped that further infection experiments may be carried out next spring.

I wish to thank Dr Malcolm Wilson, at whose suggestion this investigation was carried out.

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(*Accepted for publication* 10 *December* 1939)

REVIEWS

Le Genre Mycena. Par Robert Kühner. Pp. 710. Paris: Paul Lechevalier. Frs. 300.

Dr R. Kühner, has produced a remarkable monograph, one which will be the standard work on the genus *Mycena* for many years to come; all that is missing is coloured plates of the species—we hope they will be forthcoming in a subsequent volume. The method followed is unlike that in his monograph of the genus *Galera*, where he was inclined to overload his descriptions with unessential detail. The diagnoses are, however, complete, and give a clear view of the species and varieties. They are accompanied by line drawings of the microscopic characters, and supplemented by drawings and descriptions supplied by eminent colleagues. He has not thought it necessary to give an outline of the spore of most of the species; an unfortunate omission, in our opinion. The classification is new. The primary division is into species with amyloid spores (*Eu-Mycena*) and non-amyloid spores (*Para-Mycena*), though he has had to place at least two species with non-amyloid spores in the first group, because they were too nearly related to other species to bear separation. *Mycena pseudopura* Cooke is maintained as a species, the spores not turning blue in iodine as contrasted with *M. pura* which has amyloid spores.

Further grouping follows partly the Friesian system with many modifications based on microscopic characters. Cystidia play a large part in the diagnoses. Our only criticism is that in a few species the author has adopted epithets that go counter to tradition. A few examples may be given of common species familiar to British mycologists:

M. ammoniaca Fr. becomes *M. metata* (Fr.?) sensu Schröter.
M. metata Fr. becomes *M. vitrea* (Fr.?) var. *tenella* (Fr.?) sensu Ricken.
M. vitilis Fr. becomes *M. filopes* Fr. (ex Bull.?) sensu Schroter.
M. filopes (Bull.) Fr. becomes *M. vitilis* (Fr.?) sensu Ricken.

Dr Kuhner's explanation of such changes is that he has felt bound to adopt the name as applied to the first complete description giving microscopic details. This is a sound method, but should hardly be followed where there has been an obvious mistake in determination. We are not bound to accept Dr Kuhner's nomenclature, but in using our more traditional names we shall have to make it clear in what sense we intend them.

In the preparation of this monograph the author has used in an impressive manner all the technical resources open to modern mycologists. Fortunately, this technique is not necessary for the determination of species. Two general keys are provided, and keys to each group which we have found very helpful.

Kühner has transferred a large number of *Omphalia* species to the genus *Mycena*. There were already several Mycenas with decurrent gills; for instance *M. rorida*, *M. cinerella*, *M. epipterygia* and *M. vulgaris*, and Fries included many Omphalias in his section "Mycenarii". On the whole, Kühner's view is probably sound, but will not appeal to everybody. He has with less justification and rather hesitatingly transferred a few species with amyloid spores from other genera, including them in a group "Spuriae", with the proviso that they may eventually go into independent genera. Many American species are described, thanks to the co-operation of Alex. H. Smith. Latin diagnoses of new species appear at the end of the volume.

In the preface a full account of the genus *Mycena* is given. The author himself has worked out the cytology of a large number of species, and gives a detailed and well illustrated account of the nuclear developments. Dr René Maire provides an introduction. The work is indispensable to all serious students of the Agarics.

A. A. Pearson.

Les Champignons Toxiques. Par R. DUJARRIC DE LA RIVIÈRE et ROGER HEIM. Paris: L'Encyclopédie Médico-Chirurgicale. 1938. Frs. 45.

The authors of this work have brought together all the available information on the subject of the toxic qualities of fungi and the appropriate medical treatment. They are well qualified to undertake this task. Dr Heim is the Assistant Director of the Cryptogamic Department of the Natural History Museum in Paris, and Dr Dujarric de la Rivière, of the Pasteur Institute, has specialized in the treatment of fungus poisoning; he discovered, or rather perfected, the serum which seems likely to prove the most effective curative agent against poisoning by *Amanita phalloides* and its relatives, *A. verna* and *A. virosa*. The delayed symptoms and the complicated effects render medical treatment extremely difficult, and death has resulted in at least 50 % of the cases recorded. The serum constitutes the best treatment, but the chances of having it available when needed are remote. German physicians have experimented with glucose injections, with some good results. A successful treatment in 1936 by a French doctor suggests possibilities. Not being able to obtain the serum, he gave his patients, every half hour, a glass of cold water with a spoonful of sea salt added. The effect was immediate. The patients ceased vomiting, rallied, and were ultimately cured. Confirmation of the results of this simple treatment is needed.

Fortunately, the other forms of fungus poisoning are less serious. These forms are classified into ten categories, chiefly according to symptoms: whether affecting the cell tissues, nervous system, intestines, blood, muscular fibres, lungs, etc. Most species possessing some toxic quality come into one only of the categories; a few overlap into others. *Lepiota helveola* sensu lato is attached to the phalloidian category, but has not the same catastrophic effects. Deaths are reported from time to time as due to the consumption of fungi other than *Amanita phalloides*, but they are rare, and often due to subsidiary causes. Personal idiosyncrasy is doubtless an important factor. There is much contradictory evidence as to certain species which many people can eat with impunity and even relish, whilst others suffer serious digestive consequences; the mushrooms that turn yellow are best known in this respect, but other species recommended as edibles are in the same class such as *Clitocybe nebularis*, *C. geotropa*, *Tricholoma irinum*, etc. Among the species of *Russula* all the mild species are good, and the acrid ones either nasty or indigestible; though we remember meeting a Lett woman in Epping Forest, gathering *Russula emetica* for the pot and rejecting all others because her husband preferred it.

Some species with a sinister reputation have been rehabilitated in recent years, such as *Amanita mappa* and *Volvaria speciosa* (= *V. gloiocephala*). The first is not worth eating, but harmless, whilst the second is considered of culinary importance in some parts of the world. The suspect species of *Lactarius* such as *L. torminosus* are no longer looked upon as dangerous, and *Lactarius piperatus* is much appreciated by many mycophagists. Practically all species of *Boletus* are edible, even those that turn blue, with the exception of *Boletus satanas* which is indigestible. The wildly intoxicating effects of *Amanita muscaria* are well known, but statistics show that *Amanita pantherina*, which also affects the nervous system, has caused more deaths. Some of the white species of *Clitocybe*, especially *C. rivulosa* and *C. dealbata*, and many species of *Inocybe* seriously affect the nervous system. *Entoloma lividum* and *Tricholoma tigrinum* produce gastric troubles, and if you want a good purgative, *Clavaria formosa*, *Entoloma rhodopolium* and *E. nidorosum* will have the desired effect. *Coprinus atramentarius* does no harm to water drinkers, but may give a bad time to those who drink wine or any other alcoholic beverage, even some hours afterwards. Among the Discomycetes, *Gyromitra esculenta*, in spite of its name, has frequently been the occasion of serious trouble when consumed fresh without pouring away the water it is boiled in; it is, however, perfectly safe in the dried state, and large quantities are sold.

Most of this information was already familiar to mycologists, but it is useful to have it epitomized in this volume, which also has a complete list of the literature and eight coloured plates from the brush of M. Bessin. It is an invaluable addition to the library of the mycologist and especially to that of the physician.

A. A. PEARSON.

VOLUME XXIV SEPTEMBER 1940 PART II.

PRESIDENTIAL ADDRESS ON SPECIMENS, SPECIES AND NAMES

By E. W. MASON, M.A., M.Sc., F.L.S.

PREFACING the first of that succession of addresses which has adorned our amateur side, Plowright said straight out, and with engaging candour, that long presidential addresses were rarely interesting; that, dealing as a rule with generalizations, they lacked the piquancy of concrete facts; and that, being usually post-prandial, they tended to be soporific. To be sure, he spoke of forty years ago, and a modern audience may be of tougher fibre; but before we find that out, I hasten to thank you for your compliment in electing me this year's president, and then, perhaps as a ship that passes in the night, onward to my theme.

The intention is mainly this: as for nearly twenty years we have together explored the English woods, to-day I would explore with you that ground which is common to us all—the just diagnosis of the specimens we collect; but especially as that presents itself to the modest hewer of wood. Now by the term diagnosis I mean our assignment of a specimen to its species, and usually we have plenty of species from which to choose. A census of British Pyrenomycetes, for instance, shows that 1423 species are already recorded; so I will approach this subject by inviting you to consider the doubleness inherent in this innocent-looking little statement, that some 1400 species have been recorded. Let us turn to our classics.

Here then are two quotations: "When on board H.M.S. *Beagle* as naturalist, I was much struck with certain facts in the distribution of the organic beings inhabiting South America. These facts seemed to me to throw some light on the origin of species...." And again this: "When a species is divided into two or more species, the specific epithet must be retained for one of them...." The first quotation you will recall is from Mr Darwin, introducing his hypothesis of the origin of species by means of natural selection; the second is from Article 52 of the International Rules of Botanical Nomenclature.

Now, one might imagine that those who frame these rules sit round a room, and watch one of Mr Darwin's species being divided into two or more species; but that is not so. They do their work entirely undistracted by the presence of mundane plants, and there is no sort of mystery about the origin of the species that they discuss. For there are indeed two sorts of species. The first, the real or objective species, the sort that has our heart and that Mr Darwin had in mind, consists

of real animals or real plants. The second sort, on the other hand, the nomenclatural species, is almost entirely an ink-and-paper affair, and each of them consists of a Latin specific epithet, at least one human author, a date and a description; and if justice had been done, each, ere this, would also have been anchored to reality, by the designation of its type specimen. Now it is sometimes claimed, in my view unhappily, that a species was created by a botanist; the most that should be said, and that in only a few instances, is this: "An apt mind has been stirred and has poured itself out nobly in adoration of what it believed that it saw." But we must return to our Pyrenomycetes.

Let us suppose now that we could make one big pile of all the material in the country; that we could sort the plants out correctly into their real species; that we then found that we had made exactly 1400 heaps of plants; and, lastly, that all the plants in each heap answered precisely to the description of one of the species in the census. Why, then we could say that we had specimens of 1400 real species in our country, and that we had the same number of good—good enough for us—nomenclatural species on our books. Then for the future, and with a good conscience, we could dedicate ourselves entirely to the higher mycology. But that time is not yet.

Assuming then that there is something still to do, and that it is not going to be done for us by others, what of the methods! They are still, I take it, the same three that were adumbrated by the younger Hooker in 1857. He premised that three men were called upon to describe the camel. The first embarked forthwith for Egypt, the second walked round to the Zoological Gardens, and the third shut himself up in his study and thought it out. The first is the way of the collector—acquaintance with a full range of specimens as they occur, and "camels" I am informed occur in Egypt only as "dromedaries". The second is the way of the experimenter—acquaintance with a few specimens under rather controlled conditions. And the third is the only way open to us when we are not acquainted with any specimens at all.

I must pause here lest anyone in this room should be incautiously assuming that he has collected *Armillaria mellea* or *Botrytis cinerea*. The test is indeed a simple one; for if he has, then there is no more left in the world for anyone else to collect. When we say, "This is *Armillaria mellea*", we are not making a statement of fact; we are employing a misleading ellipsis. That name is not the proper name of the specimen in our hand; it is the common name of all the specimens of that species—past, present and to be. We mean, "This is a specimen of *Armillaria mellea*", or, heeding the admonition that our manuscripts must be typed, carefully revised and kept as short as possible, "This is an *Armillaria mellea*, this some *Botrytis cinerea*".

While then it is not possible to collect a species, I would still em-

ploy this unaccustomed hour in preaching this doctrine—that the nearest any of us can get to a real species is in collecting and studying a full range of its specimens; that as it is axiomatic for a writer that the adjective is the enemy of the noun, so should it be axiomatic for us that the taxonomist is the enemy of the real species; and that, though book-botany is an excellent walking stick for our foray members, it should never be allowed to usurp the place of specimen-botany by coming between a naturalist and his specimens.

To-day, however, we are not thinking of the common or camel species: if we were, our specimens would be individuals, and our species would be what the books and the American Phytopathological Society say they should be—groups of individuals; but the fungus-hunters' specimens are rarely individuals at all, but something else.

Consider the historical specimen of *Clitocybe gilva* that was collected at Epping in 1909; and how Mr Gould thought that, if he could collect a descendant of that specimen in 1936, it would probably be given another name. If, however, twenty-five years later a second specimen were collected in about the same nook, it would be altogether likely to be another specimen collected from the same individual plant, and not a descendant of the first specimen at all. So here is a distinction that must be present in our minds when we are dealing with many a fungus species. Just as the "individuals" that we collect in the field are individual specimens and not individual fungi, so the descriptions, given by our favourite authors of the great majority of species, are descriptions of individual organs, and again not of individual fungi. In practice we never see the individuals, and so for us they exist merely as abstract generalizations.

But, you will say, modern laboratory methods have altered all that, and when we grow fungi on transparent media the whole individual is laid bare before us. Let us recall then Miss Sampson's account of smuts in culture and how they were not picturesque, but were liable to form a grey-brown gelatinous-looking mass, sometimes with a corrugated surface resembling miniature mountains and river valleys; but how nevertheless one could learn to recognize the face of a colony with the accuracy of a farmer who knows his own sheep. Now it is all very well to compare a smut colony with a sheep, but no farmer has a sheep that he can turn into a thousand more sheep which he cannot tell apart—or perhaps into a thousand of the same sheep, no one is quite sure which—by shaving pieces off the first and planting them.

It is not clear—it is not indeed—where one fungus ends and the next begins; and that, I suppose, is why we are wont to refer to all the specimens of a fungus species as "the fungus itself", although one fungus does not make a species.

But the elusiveness of the individual fungus confounds us not only

when we are talking about fungi at large; it lays a quite special trap for us when we rely on cultures to teach us the limits of a species. We are all too prone to think that we can start with one spore or one hyphal tip, and that, by growing a room full of subcultures at various temperatures and on all sorts of media, we can establish the full variation of their species. That, however, would not be so, even if we examined all the specimens that we had produced. For if we start with one ascospore and make a thousand subcultures, the range of specimens we shall observe will not be as that of a thousand ordinary sheep; but rather as that proper to a thousandfold identical twins. If, on the other hand, we start with one conidium or one hyphal tip, our mental picture is a little more hazy; because the specimen, which originated our conidium or hyphal tip, may or may not itself have originated from the fusion of several ascospores, themselves from different sources. Even then the variation that we shall observe will be no more than that proper to a single miscellaneous sheep that has had a thousand different opportunities of growing up. If our aim then is to establish the full range of a species, we must reconcile ourselves to the fact that we cannot accomplish it merely by multiplying a single specimen *ad infinitum*.

As in the delimitation of a species, so for the diagnosis of specimens, the value of cultures has been overrated; and mycologists are still with us who think that it is more scientific to name a fungus in a test-tube than a fungus as it occurs. But the surest basis of the art of diagnosis is unchanging and is this: the matching of good specimens of the species to be named against good specimens that have already been correctly named. If a collector wishes anything that he collects to be matched with named material of a species, he should include ample good sporing material in that state in which specimens of that species were first collected and described. Lacking that state, it cannot be matched directly but only with the eye of faith. Our culture methods are indeed favourable enough for the study of those species, whose specimens immediately increase and multiply, whenever they are given a diet of boiled vegetables; but they are, on the contrary, unfavourable for the study of those species which are more racy of our soil; and whose specimens either will not increase, or exasperatingly will not multiply, without a diet either of living plant parts or of weathering dead ones.

But there is another point here: when the innocent old-world phanerogamist planted a primrose seed, then—for a primrose by a river's brim a yellow primrose was to him—he never expected that there should come forth onions. But when we plant an ascospore of a Pyrenomycete, what comes forth may not be recognizable even so far as that it ever was a Pyrenomycete. Further, it is rare to find that all the species of a genus behave with precise regularity in the produc-

tion of secondary spores; nor indeed can that be guaranteed even for all the specimens of a single species.

Moulds—*Mucor*, *Aspergillus*, *Penicillium* and the like—are quite at home in a jam jar; hence if we wish to increase our acquaintance with them by multiplying their characteristic fructifications, nothing is more reasonable than to grow them in glass dishes for that purpose. But consider now the unfortunate smuts grown under similar conditions. As the saying is, these plants are not themselves. They have not become domesticated plants, for there is tremendous joy in a laboratory whenever one is seen to breed. Still less are they wild plants, for no collector has yet found anything like them growing wild. Their study is not the study of plants as they occur, but the study of plants as they do not occur. The game is up if they are not named before they are planted in a tube; for while the observer wonders if he has a new-to-science species, it is only certain that he is looking at a new-to-nature specimen. Each can be named only after it has been linked with a fungus that has been discerned, collected, described, classified and preserved in the good old way. Hence the rule is this: that outdoor fungi should be matched so far as may be with other outdoor fungi, and that the indoor specimens that are produced from them by culture work should be reserved for other purposes.

And now it is more than time to approach the subject of diagnosing the specimens that we collect; and here I fear that some of us will part company. For, year after year, "What is truth?" said the jesting toadstools—said to me of course—and would not stay for an answer; and as each year's specimens were shot into the dustbin, I could not but recall the melancholy adage that dead men tell no tales. So, in order to illustrate this address, which after all is designed to be about specimens and species, my few examples will be taken from the wood and bark Pyrenomycetes, a group of fungi that, more than all others, build for the future, and above all others so well deserve their beauty.

But first it will perhaps be well to remind you that the name Pyrenomycete includes all those fungi which produce perithecia; that perithecia are hard or soft receptacles of such a size that they can be seen by the naked eye; that the asci, which are membranous sacks containing the ascospores, are formed within the perithecia; and that, while the presence of asci and ascospores can easily be demonstrated in the field, the individuals of each are too small to be seen without the aid of a microscope.

Now while to you or to me a perithecium may appear a matter of fact enough piece of apparatus that is there to disperse the ascospores, or at any rate to present them for dispersal, there is said to be more in each perithecium than meets the eye; as that its wall belongs to a first generation, the ascus walls within it to a second, and the

ascospores themselves to a third, which is perhaps, confusingly enough, the first again. But however many generations there may be, they may go now, because for this afternoon they all constitute a single perithecium, and a single specimen has many perithecia.

Just as the species of Agarics are recognized by and described from their sporophores or their toadstool parts, so, for our time and generation, the species of Pyrenomycetes are recognized by and described from their perithecia. Now the perithecia develop a succession of asci against a succession of rainy days; and so if a specimen with ripe perithecia is removed to the shelter of a house, it awaits uncomplainingly the next rainy day for a very long time; and many have already been waiting for a hundred years and are still in almost as good condition as on the day they were collected. Perithecia then are in themselves superior subjects for the specimen botanist; and, as will immediately appear, those of the wood and bark species present also another great attraction. With a few bizarre exceptions, such as those of *Xylaria*, they are embedded in, or erumpent from, or closely moulded on to wood and bark, and accordingly, as some of you have observed, portions of their intimate habitat are readily collected with them. And once again, the perithecia of our *in situ* specimens, in almost derisive contrast with the wildly woolly ones of *in vitreis* specimens, retain the clear cut outline original to their design.

Next Pyrenomycetes are betwixt-and-between fungi, that is to say, the species are to be recognized by eye characters, and their identity confirmed by microscopic characters. Now, just as in recent years examination of a fungus in a test tube has been considered the hall mark of "scientific methodology", so examination with a microscope has been held to be more fundamental than examination with the naked eye. The danger of this, however, is that we may become micro-minded and see the significance of our observations as much magnified as the disarranged fragment of the specimen that we are examining. But the micro-fungi do not inhabit a micro-world but the same world as that in which we live, with the same wind, the same rain and the same insects, as well as the same trees and shrubs. The effective range, for instance, of the annual cloud of rust spores in America is much the same as that of a balloon barrage, gloriously freed; and that is because *Puccinia graminis* can manufacture a macroscopic powder of spores, can keep its powder dry, and the wind passeth over them and they are gone. Hence when we start looking at specimens of Pyrenomycetes in their surroundings, the presence of a septum or two in their ascospores appears unimportant, unless, from our further experience, any such attains some unexpected significance. Nevertheless, each of our modern genera of Pyrenomycetes is limited by definition to one of the spore groups, and the name of each spore group refers to the number and arrangement of septa in the colourless

or coloured ascospores. What a pity! Not only because a septum with a hole through its middle is dull in itself, but also because it may be the cause of dullness in us, so that, as has so often happened in the past, specimens of the same species may continue to be classified in diverse genera.

It is clear then that the collector is in need of help in diagnosing his specimens; and help is at hand just because perithecia never do occur *in vacuo* but always in sundry places. So for this afternoon we are turning our backs on the twenty-five or some other number of families in which too numerous descriptions of species are to be found, and are looking rather towards the sundry places which we can see very well with our ordinary eyes; and this is what we do see.

First the enormous majority of perithecia that are formed in this world without our aid, are formed in some close association with portions of a phanerogam; and seen closer, they group themselves as the inhabitants respectively of (1) wood and bark, (2) herbaceous stems, (3) leaves, and (4) the detritus, after our ruminant fauna has finished with it, of the first three habitats. In addition there are small subsidiary groups, such as those whose members inhabit other fungi, or insects. In practice it is usually found that one of these groups is more than sufficient to employ the weekends of any suburban botanist; and so our examples to-day must all be taken from one group, the first—the wood and bark Pyrenomycetes.

There are, then, the perithecia, there are the asci and there are the sundry places; the perithecia are to be distinguished by eye from all others that inhabit the same places and their diagnosis is to be confirmed with the help of the microscope. Now places display themselves in an infinite variety, and so we are soon back again in our familiar and still pleasingly unpolysyllabic world, a world of common places and of exclusive places, but especially of timber in the round; of living, and of dead, oak and ash and thorn; as well as of sound wood, and scorched wood, and decaying wood and rotten wood; in a world then not only of the unforgiving minute, but also with the English landscape in it. And here is a minute fragment of it.

Hypoxylon argillaceum is notable among species of *Hypoxylon*, not only because its specimens may profitably be searched for with field glasses, but also because they are strictly limited to one tree, the ash. The presence of perithecial stromata of *H. serpens* should be confirmed with the toe of a boot; for while they may occur on any tree or shrub, they are always situated immediately above wood that has lost its identity, that is, which has become completely rotten. A useful grouping is that of species whose perithecia first burst through more or less unchanged bark soon after the death of a branch; I am wont to differentiate them as fungi of first incidence. It includes such vagrants as *Nectria cinnabarina*, *Hypoxylon rubiginosum* and *Diatrype stigma*.

Each of these three is also an indicator of a secondary species: the first of *Nitschia cupularis*, the second of *Tympanopsis euomphala* and the third both of *Calyculosphaeria tristis* and also of the species with which that was so long confused, *Chaetosphaeria phaeostroma*. Specimens of such secondary species are found only on branches previously infected by one or other of their indicator species.

Lasiosphaeria spermoides produces conspicuous sheets of perithecia over the cut surface of stumps, but only of such as have been first infected by the rhizomorphs of *Armillaria mellea*.

A species that is characteristic enough of a host plant may occur upon it only as a secondary to the fungi of first incidence of that host. Thus on birch branches the first comers are the perithecial stromata either of the commoner but less conspicuous *Pseudovalsa lanciformis*; or of the less frequent but more conspicuous *Melanconis stilbostoma*, both of which occur only on birch; or of *Diatrypella favacea* which occurs on all trees except oak. Later, perithecia of *Calosphaeria* .*Wahlenbergii*, a characteristic secondary on birch, may be found nestling between the bark and the taut periderm of the same branches, especially when sought for with the tips of the fingers.

The perithecia of the species of genuine *Ceratostomella* are stated, in the generic description, to be superficial on wood; any, however, that are completely superficial are worthless to the collector as they are always empty. The valuable perithecia are embedded separately in the wood, and the slender projecting beak of each can just be detected when the eye is aided by a glancing sunbeam. They may be found, however, easily enough when sought in the right place—wood so rotten that a finger can be poked into it, and in which conspicuous channels have already been gouged out by the larvae of long-horn beetles.

Valsa ceratophora follows fire, and its stromata form abundantly up the scorched stems of all the young standing trees and shrubs involved. Usually, however, only those stromata which are formed in the collar regions answer to the description of the species; so *Valsa ceratophora* has half a hundred different names described from single collections of stromata, on one occasion found flush with the periderm, and on another exserted into a besom of beaks; in thick bark or in thin bark; and severally on all the different trees and shrubs of the Northern Hemisphere. But they have all been called *Valsa*.

Specimens of *Diatrvpe stigma*, however, are not so fortunate. When they occur, for instance, on young branches of beech, they have to burst out through the taut young periderm, and develop a white ectostroma for that purpose. The generic name *Diatrype* refers to this splitting apart of the periderm. When, however, specimens are forming, sometimes several feet long, in the thick bark of an old beech log, no ectostroma is formed and the specimen follows the contours of the

bark, or, after the bark has gone, of the wood. Such specimens have then received several specific names in the genus *Eutypa*; and in one favourite classification have changed not only their generic, but also their family, name. And that is only the specimens on beech; there are others on our other trees and shrubs.

Of making names, then, there has been no end, but now is our chance to find out what is in any of them—if indeed that is in us. The fungi of first incidence should be our first concern, for in the past the presence of one of them has provided the occasion for many a discourse on parasitism and saprophytism; and hence it has come about that the presence of one of them now may provide occasion not for the use of a single name, but rather for a conversazione.

This process of recovering our real species from the phantasmagoria of book-botany has little more than begun, and as yet affects hardly more than the most conspicuous species. Remember the fifty-three specimens of *Hypoxylon rubiginosum* in the Kew Herbarium, and where precisely Dr Miller found them; twenty indeed in the *rubiginosum* folder, three in that of *cohaerens*, four in that of *atropurpureum*, three in oddments and twenty-one in that of *multiforme*. Some of these specimens had been in residence as museum pieces since 1836. We know all about *rubiginosum* now, and how, in these parts, it may occur on all trees and shrubs, but only in the immediate vicinity of mature ash. But if that had been known in 1836, our *multiforme* folders would now be emptier than they are, for as soon as the precise habitat of a species is known there is little difficulty in distinguishing its specimens from those of any possible neighbour.

When I first looked at perithecia and then looked at the welter of possible names in the books, it seemed to me that applying a name to the first must be as difficult as naming the grains of sand on a seashore. But I know now that I was endeavouring to proceed along the wrong road, the high road that is signposted with palimpsests of family and generic names. So to-day I am recommending the low road, the road of seeing places, and of hail fellow well met, and now and again of "Dr Livingstone I presume"; the road along which we may be continually collecting fresh inspiration as we collect fresh specimens, until perhaps upon some great occasion: "All is in the wine press; all is in drunken ecstasy and the grapes begin to stammer." But we must pass on to the activities of this year.

You may have read in the *Transactions* how your Plant Pathology Committee rounded off last year with two resolutions which have since been implemented; how they appointed a subcommittee, with Mr Moore as convener, to keep under annual review the binomials in their "List of Common Names of British Plant Diseases"; and how, naturally then, the urgent alterations were submitted, corrected and approved, and are already published with reasons given; how also,

at the instance of that Committee, well served by Dr Ainsworth's able pen, "forty-two Offices, Societies and Institutes of Great Britain [ourselves included] have agreed to respect these fungus binomials as closely as possible in their official publications"; and also how the same Committee proposed that the name *Urocystis* should be conserved against the name *Tuburcinia* chiefly on this ground—"that the name *Urocystis* has been well known to, and in frequent use by plant pathologists since there has been a science of plant pathology, and accordingly should not be discarded without cogent reason". And how your Council inaugurated a Nomenclature Committee, which faithfully got to work on some of the generic names that have been proposed for conservation; tabulated all the relevant material it could find, and ventured to express its own, but agreed, opinion on the least injurious actions possible.

Our *Transactions* then have been appearing in full measure and with almost precise regularity; and the two spring London meetings held were well attended, and included a greatly enjoyed hour of cinema display. The papers which were read reflected our wide range of interests, and were probed and praised with all our usual gusto. Our outdoor mycology, on the contrary, can be briefly chronicled. Ominously enough, only thirteen of us met at Arundel, and the fungi proved to be hardly either here or there. The pathologists met at their full average strength for their day at Jealott's Hill, but then the curtain falls.

Such is the foreground of the picture, that is framed in our eventide of peace; and I will now attempt to shadow forth its background. As is so often recalled, we began as a comradeship, mainly of amateur naturalists, than whom, as we know well, none are more generous with all their information. Thereafter our membership has become more and more professional, and what may be termed the newer botanologies have successively pretended to the saddle; hence our species have tended to become less fashionable, and the flame of our younger naturalists to become extinguished. But a later tendency can also be discerned: to moot, as all in all, pure science for its own sake, and in love with its own reflexions, so that already some half of us owe our main allegiance to applied mycology. Chief and most numerous of these are the plant pathologists, whose main business is to hold unceasing strife with the few fungi that can play havoc with our major crops; and who need no multitude of names, many used but once in a lifetime, but the few names that are always on their lips and are repeated month by month in at least two periodicals.

Now names do not belong to fungi, which have neither speech nor language, but to us. Their use is not that all fungi may be understood by all mycologists, but that we may be understood by one another. Hence it would appear eminently proper that fungus names of great

public importance should be confirmed, and no longer like "children being carried away with every blast of vain doctrine". So I am glad that our ambidextrous Society has attempted something of this sort, and that what was done was done with such unanimity.

And now for a brief glance through the modern nomenclatural kaleidoscope. Generic names are to be associated for all time with three things: an author's name, a date and a type species. The uses allotted to the author's name, though necessary, are humble; for there can be no date without a publication, nor a type species unless the author put it in his genus. The date too subserves two ends: both to fix the precedence of the genus in the hierarchy of names, and to restrict the choice of the type species to one of the original species of the genus. The mischief arises when a discarded type species, specimens of which are known to some one in a thousand mycologists, is thus again foisted upon us, as when, for instance, the genus *Sphaeropsis*, the foremother of the Sphaeropsidales, was suddenly proclaimed an Ascomycete.

A mass migration of nomenclatural species is always threatened whenever a generic name, substantial of species and ripe of years, is disestablished. And for many years now, any number of old generic names that are almost household among us have been held in a state of suspended disestablishment. Under the modernized rules, these key names must go unless they be conserved. They have mostly been proposed for conservation, but while Congress keeps each decision in its own hands, it makes no haste. This year your Nomenclature Committee, with Miss Wakefield as Secretary, did at least get down to some cases, and published its opinion on them for your information; but unless and until the Special Committee for Fungi, appointed by Congress, itself gets down to cases, there can be no mycological precedents of any international status.

And now we are approaching the close of our first wartime meeting, as of this exciting year; and I will approach my close on a note almost of apology to our hosts, for what we have brought with us. As you have perceived, this address is hardly in the urbane atmosphere of the Linnean Society of London: indeed, it was planned for a very different purlieu, the rough and tumble of our autumn foray in the pastoral setting of Chipping Campden. There, so it seemed, it might best contend with the natural effect of a long day's collecting, if designed as a running commentary for a jog-trot hour, without benefit of footnotes, nor continued in a bibliography. But our hosts who, a shining example, are at their post, will no doubt indulgently accommodate it, as one of the minor horrors of war; remembering that, for the first time, we have been compelled to honour in the breach our peculiarly own harvest home in England's green and pleasant land.

LISTS OF BRITISH FUNGI

In November 1935 the Plant Pathology Committee considered a proposal from Dr S. P. Wiltshire that the Committee should compile a List of British Fungi, and a resolution was passed expressing the opinion that the compilation of such a list would be very desirable both from the phytopathological and mycological aspects. A Sub-Committee consisting of Dr S. P. Wiltshire (Chairman), Mr W. Buddin (Secretary), Mr K. St G. Cartwright, Mr W. C. Moore, Mr J. Ramsbottom, Miss E. M. Wakefield and Dr H. Wormald, appointed to consider ways and means, reported to the Committee in March 1936 that although a complete list of British Fungi was at present impracticable, the same object might ultimately be achieved by compiling lists of individual groups of fungi, on a common pattern. It was suggested that the fungi listed should be those recorded for the British Isles, whether given in British or foreign works, that all records providing new information should be included, that annotations should be restricted to points of taxonomic or biological interest, and, to secure uniformity of citation and to economize printing costs, that periodicals, monographs, floras and other works recording large numbers of fungi should be quoted by numbers instead of by names.

Offers to compile two such lists had then been received, one from Miss Wakefield for Hyphomycetes, and the other from Mr J. Ramsbottom for Discomycetes.

The Committee agreed that the work should proceed on these lines, and, subsequently, offers to compile lists of Phycomycetes (Dr C. G. C. Chesters), Pyrenomycetes (Dr G. R. Bisby and Mr E. W. Mason), Ustilaginales (Miss K. Sampson) and Uredinales (Dr Alex. Smith) were received and accepted. The following list of Pyrenomycetes is the first of the lists to be completed; the others will be published as they are ready.

The Committee takes this opportunity of thanking Dr C. E. Foister, Dr Lilian E. Hawker and Miss E. Oyler, who, in addition to past and present members of the Committee, assisted those in charge of the lists with the task of searching the literature for records.

W. Brown,
Chairman, Plant Pathology Committee.

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LIST OF PYRENOMYCETES RECORDED FOR BRITAIN

By G. R. BISBY and E. W. MASON

Introduction

1. *Historical.* Pyrenomycetes were reported in Britain in the seventeenth century by Ray and others. Near the beginning of the nineteenth century Dickson, Bolton and Sowerby supplemented their descriptions with illustrations of the external characters of their specimens. Greville (1823–8) published 360 excellent coloured plates (240 illustrating fungi), with descriptions. Greville was one of the first British mycologists to figure ascospores and to preserve specimens systematically.

On the Continent, Persoon (1801) compiled some 200 Pyrenomycetes. Fries (1823) brought together the descriptions of about 600 species, 550 under the genus *Sphaeria*, classified on the appearance of the perithecia *in situ*. He divided *Sphaeria* into Compositae, with four Sections and sixteen Tribes named and briefly characterized, and Simplices with three Sections and eleven Tribes. Although he gave little attention to asci or spores, few pycnidial fungi were included. Between 1819 and 1834 Fries issued 450 numbers of his Scleromycetes Sueciae (the majority Pyrenomycetes), which supplemented the descriptions in the *Systema*.

Sphaeria, as used by Fries, included the modern Sphaeriales and Hypocreales. Saccardo classified these orders into genera on characters of ascospores. Winter based Families on the "Sections" and "Tribes" of Fries, but his classification is no more "natural" than Saccardo's.

Berkeley's account of British fungi in Smith's *English Flora* (1836) marks the beginning of "modern" mycology in Britain. He was later in touch with Fries, Montagne, and others, and was ably assisted by Broome. Currey studied many of the Pyrenomycetes included in W. J. Hooker's herbarium, and described and figured their asci and spores. Cooke in 1871 published his *Handbook* with descriptions and a careful compilation of records. *Sphaeria* was still a very prominent genus, but during the years 1850-80 the emphasis on ascospore characters as criteria for genera was resulting in its gradual elimination. One important result of making the microscope the main guide to generic characters was the loss of emphasis on macroscopic features. Cooke (1875) protested, and (with Plowright,

1879) proposed to save the "natural system" of Fries by making the Friesian "Tribes" the basis of new genera, e.g. *Byssosphaeria* Cooke for "Sphaeria, Byssisedae Fr.", *Psilosphaeria* for "Sphaeria, Denudatae Fr.", etc. Cooke did not hesitate to re-characterize some of the then recent genera to fit this scheme. Transfers from Cooke's *Handbook* (1871) were indicated without being made: for example, "Genus 9. *Conisphaeria* Cke." was cited with a short diagnosis, followed by "Sphaeria, Pertusae Fries in part" then "Species, Handbk., nos. 2604 to 2611" and "*Conisphaeria paedida* B. & Br." (an addition to the *Handbook*). The last name may be cited now as *C. paedida* (Berk. & Br.) Cooke, but nos. 2604 to 2611 were not validly transferred. In the same year, however, Stevenson (1879) cited by name under *Conisphaeria* nos. 2604–6–7–8–10, and also no. 2621 of Cooke's *Handbook*. Thus no. 2604 is cited "*C. pertusa* Pers. *Sphaeria* C. Hbk. no. 2604", and it therefore becomes *Conisphaeria pertusa* (Pers. ex Fr.) Stevenson. Sometimes the first actual citation of Cooke's suggested names appeared in the papers of Bucknall (1878–91) or others.

In 1882 and 1883 volumes I and II of Saccardo's *Sylloge* appeared: they included the Pyrenomycetes but ignored the generic nomenclature of Cooke and Plowright. Cooke then undertook a more gigantic addition to the synonymy and nomenclatural confusion of Pyrenomycetes: in his "Synopsis Pyrenomycetum" (1884–90) he went through the *Sylloge* and set out still another "theoretical" arrangement for many of the 5928 names he included. Massee followed faithfully a few pages after each instalment and listed the British species under Cooke's names. This list of Massee's is the last complete list of British Pyrenomycetes. We have attempted to record those synonyms due to Cooke which thus appear in a British list. Meanwhile Plowright (1884) accepted Saccardo's classification.

Cooke remained active into the twentieth century, and many records of British Pyrenomycetes were also contributed by his contemporaries or successors: Plowright, Phillips, Grove, Massee, Bucknall, A. Lorrain Smith, Ellis, Hawley, Rhodes, F. A. Mason and others.

2. *The citation of authors*. Since 1910 the International Rules have accepted the *Systema* of Fries as the starting-point for the nomenclature of the Pyrenomycetes. Thus *Sphaeria gelatinosa* Tode (1790) was accepted by Fries in the *Systema*, and may now be cited as *S. gelatinosa* Fr., or *S. gelatinosa* [Tode] Fr., or *S. gelatinosa* Tode ex Fr. Phanerogamic botanists often omit pre-Linnaean authors, but mycologists seldom omit reference to Persoon, Tode, or several other pre-Friesian authors.

Fries (1849) transferred *S. gelatinosa* to *Hypocrea*, in which genus it can be cited conveniently and correctly as "*H. gelatinosa* (Fr.) Fr." or "*H. gelatinosa* (Tode ex Fr.) Fr." The latter model is followed in the

List of Species, but the former, for the sake of brevity, in the Index to Species.

Occasionally Fries did not accept an earlier generic or specific name that has since been adopted. Thus *Sphaeria pusilla* Wahlenb. was placed in the *Systema* as a synonym of *S. pulchella*. Karsten in 1873 decided that it was distinct and transferred it as "*Calosphaeria pusilla* (Wahlenb.) Karst." But this name has validity only from 1873; the species had meantime been named *Sphaeria Wahlenbergii* Desm., and this valid name was transferred to *Calosphaeria* by Nitschke. If the latter specific name had not been found, the name would have been entered herein as *C. pusilla* ([Wahlenb.]) Karst.

3. *Explanation of citations.* Saccardo's classification is usually followed. The type species of genera based on British collections or proposed by British workers are marked "gen.nov." New species and new combinations are indicated by "in" (e.g. "*Sphaeria* Berk. in **19**"); "apud" is used to avoid repetition of "in"; "as" is used (e.g. "Berk. **20** as *Sphaeria*") for other records under names not accepted. The word "ex" is used not only after pre-Friesian authorities, but also when a worker attributes the description of a species to another, e.g. "Bloxam ex Berk." Each literature citation refers to the last scientific name mentioned. Only the page of the description or record of a species is given, or the first page of several. An asterisk (*) indicates figures drawn from British specimens, not necessarily appearing on the page indicated by the asterisk. A reference marked "t." is to a figure directly. Author citations are corrected to modern usage without comment. Since a record as "*Sphaeria* (*Valsa*)" does not validly transfer the species to *Valsa*, the latter name is omitted. The authors of more important papers or lists are indicated.

The host or substratum is given very briefly; a citation "on *Fagus*, etc." means that *Fagus* is the common or type host, but that there are records on other hosts. Localities are not given except when only one or two are known. The references at the end of this section include certain important works on Pyrenomycetes; the dates of some are often cited incorrectly by authors.

4. *Remarks.* Many doubtful and superfluous names have been applied to British Pyrenomycetes: for example there are twenty-two binomials in *Chaetomium* but, as indicated, they probably represent no more than ten species. There are 121 entries left in *Diaporthe* which, according to Wehmeyer, represent twenty-seven definite species or varieties, and ten doubtful ones. We have hesitated, however, to reduce most names in these genera in the absence of further study of British specimens; both synonymy and misidentifications are involved. Only in the Xylariaceae, Hypocreaceae, and a few other groups can the British records be arranged to give a close approximation to the actual species present.

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The following table gives the groups under which the records of British Pyrenomycetes are listed, the numbers of species (plus varieties) reported, and the page references. Entries in square brackets in the List of Species indicate synonyms, errors, or conidia only, and are not counted here.

Group		No. of entries	Page
Laboulbeniales		40	131
Gymnoascales		21	132
Perisporiales			
Eurotiaceae		26	133
Erysiphaceae		27	135
Perisporiaceae		11	136
Capnodiaceae		8	137
Sphaeriales			
	With ascospores		
Amerosporae	One-celled, not filiform		
Allantosporae	Sausage-shaped	90	137
Hyalosporae	Not allantoid, pale	75	143
Phaeosporae	Not allantoid, dark	166	147
Didymosporae	Two-celled		
Hyalodidymae	Pale	278	157
Phaeodidymae	Dark	67	173
Phragmosporae	With two or more cross septa		
Hyalophragmiae	Pale	84	176
Phaeophragmiae	Dark	150	181
Dictyosporae	With cross and longitudinal septa	83	189
Scolecosporae	Filiform, with or without septa	31	193
Hypocreales			
Nectriaceae		109	195
Hypocreaceae		31	202
Lophiostomataceae		27	204
Dothideales		23	205
Myriangiaceae		4	207
Microthyriales		16	207
Hysteriales		56	208
	Total entries	1423	

LIST OF SPECIES

LABOULBENIALES

British mycologists have not searched for Laboulbeniales. The records below are all from determinations and reports by the late Dr Thaxter. *Laboulbenia vulgaris* and *Stigmatomyces purpureus* were first announced by Sir Rowland Biffen. All other records were compiled at the British Museum (Natural History), and nearly all are represented there by slides. The majority have been reported by Winifrede Hake **28**[1] (IX, 78–82, 1923), with names of the insect hosts.

Cantharomyces denigratus Thaxt., New Forest.
— **italicus** Speg., New Forest.
— **Plathystethi** Thaxt., co-type, Kilburn.
Chitonomyces melanurus Peyritsch is given by Miss Hake, but was not cited as British by Thaxter.
— **paradoxus** (Peyritsch) Thaxt., England.
Compsomyces Lestevi Thaxt., England and Scotland.
Dichomyces biformis Thaxt., Leicester and Scotland.
— **furciferus** Thaxt., Scotland.

[1] Figures in Clarendon type refer to the List of References (p. 215). Roman numerals give the volume, and the number following, the page. An asterisk (*) indicates a figure or figures. Not all references have been assigned numbers (cf. p. 129).

Dichomyces hybridus Thaxt., Ealing.
— **inaequalis** Thaxt., Scotland.
— **vulgatus** Thaxt., London and Scotland.
Euhaplomyces Ancyrophori Thaxt., gen.nov., Scotland.
Euzodiomyces Lathrobii Thaxt., gen.nov., Notting Hill and Thornhill.
Haplomyces texanus Thaxt., Isle of Wight.
Helodiomyces elegans Picard, Brockenhurst.
Idiomyces Peyritschii Thaxt., England and Scotland.
Laboulbenia Cafii Thaxt., co-type, Britain.
— **Casnoniae** Thaxt., England.
— **clivinalis** Thaxt., co-type, England.
— **dubia** Thaxt., co-type, Alverstoke.
— **fasciculata** Peyritsch, Britain.
— **flagellata** Peyritsch, England.
— **Gyrinidarum** Thaxt., Britain.
— **Nebriae** Peyritsch, Whallen.
— **pedicillata** Thaxt., co-type, England.
— **Rougetii** Mont. & Robin, England.
— **subterranea** Thaxt., Cowley & Rathay (given by Miss Hake as *L. Stilici* Thaxt.).
— **vulgaris** Peyritsch. Biffen **28** (III, 83, 1909). Durnford Fen, Cambs.
Misgomyces Dyschirii Thaxt., gen.nov., England.
Monoicomyces Athetae Thaxt., New Forest.
— **britannicus** Thaxt., Hammersmith and Paisley.
— **Homalotae** Thaxt., Britain.
Peyritschiella protea Thaxt., Hampstead.
Polyascomyces Trichophyae Thaxt., gen.nov., Farnham.
Rhachomyces furcatus Thaxt., Britain.
— **philonthinus** Thaxt., Britain.
Rhadinomyces pallidus Thaxt., England. "Var. A" is also reported.
Stigmatomyces purpureus Thaxt. Biffen **28** (III, 83, 1909). Cornwall.
Symplectromyces vulgaris Thaxt., gen.nov., Britain.
Teratomyces Actobii Thaxt., Cowley & Merton.

GYMNOASCALES

The Gymnoascaceae are now considered to be Pyrenomycetes, but many of them were not recognized as Ascomycetes in the earlier literature. The Endomycetaceae are scarcely Pyrenomycetes, but British records noted for this family are included. The Saccharomycetaceae are omitted.

ENDOMYCETACEAE

Byssochlamys fulva Olliver & G. Smith in **27** (LXXI, 196*, 1933); *Biochem. J.* XXVII, 1814, 1933; *J. Soc. Chem. Ind.* LIII, 166T; *Rep. Fruit Veg. Pres. Sta. Campden*, 1933–4, p. 63; *Rep. London School Hyg.* 1934–5, p. 27; **100** (1935, 148*); G. Smith, *An Introduction to Industrial Mycology*, p. 50*. In tinned and bottled fruits, and in the field. The ascospores withstand 87° C.
Endomyces coprophilus Massee & Salm. in **33** (XV, 324*, 1901); Sacc. XVIII, 202. On dung, Kew.
Endomyces decipiens (Tul.) Reess. Ramsbottom, *Handbook of the Larger British Fungi* (33, 1923), between gills of *Armillaria mellea* (Vahl) Fr.
Eremascus fertilis Stoppel. Annie Betts **74** (VII, 136, 1912). In beehives.

MONASCACEAE

Monascus purpureus Went. G. Smith, *An Introduction to Industrial Mycology*, p. 50*. "Not uncommon, particularly in dairy products." No specific British record traced.

GYMNOASCACEAE

Arachniotus aureus (Eidam) Cohn. Massee **37** (1909, 374). On *Fagus*, Kew.
— **candidus** (Eidam) Schroet. Massee & Salmon **33** (xvi, 62*, 1902); Elizabeth Dale **33** (xvii, 571*, life history) as *Gymnoascus*. On bee's nest, dung and grass.
— **citrinus** Massee & Salm. in **33** (xvi, 62*, 1902); Sacc. xviii, 194. On dung, Kew.
[**Bolacotricha grisea** Berk. & Br. gen.nov. in **19**, no. 506*, 1851 (as Imperfecti); Sacc. iv, 317; **7**, 309, as member of Gymnoascaceae. Described on *Typha* and *Brassica*; von Höhnel (*Frag. Myk.* no. 565) found both specimens to be *Chaetomium murorum.*]
Ctenomyces serratus Eidam. A. Lorrain Smith **27** (xli, 257*, 1903); **28** (vi, 78; x, 314); Grove **27** (lx, 170). On decaying leaves, etc. A. Lorrain Smith **27** (xlii, 55) placed *Arthroderma* Currey in **68**A (ii, 240, 1854) here; the type is *A. Curreyi* Berk. in **18**, 357, 1860; Salmon **73** (2, i, 374*); *Illosporium* Sacc. in *Syll.* iv, 660.
Gymnoascus Reessii Baran. Grove **27** (xxiv, 130, 1886); A. Lorrain Smith **28** (i, 183); **68** (1901, 614); Massee **8** (iv, 19*); **33** (xv, 313 and 325; xvi, 58; xvii, 571*); **28** (xx, 217). On dung, seeds, etc.
— **ruber** van Tiegh. Grove **27** (xxiv, 130, 1886); Massee **8** (iv, 19); **74** (vii, 141*); **33** (xv, 324) as *Arachniotus*. On dung, bees, etc.
— **setosus** Eidam. Massee & Salmon **33** (xvi, 63*, 1902); Elizabeth Dale **33** (xvii, 571*, life history); **33** (l, 702); Annie Betts **74** (vii, 138*); **33** (xv, 350, 1901) as *Myxotrichum*. In beehives.
— **subumbrinus** A. L. Smith & Ramsb. in **28** (v, 424, 1917). On soil, associated with *Isaria farinosa*.
— **verticillatus** A. L. Smith in **68** (1900, 423*); Sacc. xvi, 805. On bones, Isleworth.
Myxotrichum aeruginosum Mont. Massee & Salmon **33** (xvi, 65*, 1902) report that herbarium specimens marked *M. ochraceum* contain *M. aeruginosum*.
— **cancellatum** Phill. in **14** (xiii, 51, 1884); Sacc. iv, 318. On dead stems, Shrewsbury.
— **chartarum** Kunze ex Fr. Berk. **19**, no. 121*, 1838; Cooke **15**, 612*; **33** (xvi, 65, 1902); Berk. Exs. 207. On dung, etc.
— **deflexum** Berk. in **19**, no. 122*, 1838; Sacc. iv, 318; Cooke **15**, 613; **35** (1905, 254). On old paper and wood. See next.
— **ochraceum** Berk. & Br. in **19**, no. 1475*, 1875; Sacc. iv, 318. On shavings, Bath. Massee & Salmon **33** (xvi, 65*, 1902) found *M. deflexum* on the type. See *M. aeruginosum*.
— **spinosum** Massee & Salm. in **33** (xvi, 64*, 1902); Sacc. xviii, 195; Massee **37** (1912, 165*). On bark, etc., Kew.
— **uncinatum** (Eidam) Schroet. Massee & Salmon **33** (xv, 325*, 1901; xvi, 65). On dung, Kew.

PERISPORIALES

EUROTIACEAE

Anixia cyclospora (Cooke) Sacc. in *Syll.* i, 36, 1882; **7**, 240; *Sphaeria* Cooke in **59**, Jan. 1871*; *Orbicula* Cooke in **15**, 926*, 1871. On paper, etc. The genus *Anixia* Fr. is said to be based on a Gasteromycete, but the name is used here pending study of the specimens.
— **perichaenioides** (Cooke) Sacc. in *Syll.* i, 35; *Orbicula* Cooke in **14** (viii, 10, 1879); **13**, 351; Bucknall **46** (v, 54, 1886). On old wood. Schroeter, *Krypt.-Flora Schlesien*, places this and the next two as synonyms of *Mycogala parietinum* (Schrad. ex Fr.) Rostaf.; see also von Hohnel, *Frag Myk.* no. 880. *Chaetomium glabrum* (q.v.) is probably a synonym. .

Anixia spadicea Fuckel. Crossland **7A**, 275, 1904; **7**, 240. On old cloth, Yorks.
— **truncigena** H. Hoffm. A. Lorrain Smith **28** (III, 117, 1909). On dung, Scotland.
Anixiopsis stercoraria (Hansen) Hansen. Massee & Salmon **33** (XVI, 67*, 1902). On owl castings, Kew.
Arachnomyces nitidus Massee & Salm. gen.nov. in **33** (XVI, 68*, 1902); Sacc. XVII, 532; **7**, 240. On dung and decayed plants.
— **sulphureus** Massee & Salm. in **33** (XVI, 68*, 1902); Sacc. XVII, 532. On bees' nest, Kew.
Cephalotheca Kriegeri Rehm. Grove **37** (1921, 154) considered that Cooke Exs. II, no. 413 as *Phoma chartarum* belonged here. On millboard, London. Von Höhnel **102** (1917, 361) stated that *C. Kriegeri* is a *Gnomoniella*.
— **purpurea** (Shear) Chesters in **28** (XIX, 262*, 1935). On *Fagus* and *Quercus*, Surrey.
— **reniformis** Sacc. & Therry. Chesters **28** (XIX, 261*, 1935). On *Fagus* and *Quercus*, Surrey and Birmingham.
— **sulfurea** Fuckel. B. & Br. **19**, No. 1729*, 1878; Cooke **14** (VI, 128, 1878); Bucknall **46** (III, 69); life history by Chesters **28** (XIX, 261*). On rotted wood.
Eurotium fulvescens (Cooke) Cooke in **14** (VIII, 11, 1879); Stevenson **13**, 355, 1879; Sacc. I, 28; *Badhamia* Cooke in **14** (IV, 69*, 1875). On old sacking, Scotland.
— **herbariorum** Link ex Fr. Greville **39**, t. 164, 1825; Berk. **20**, 333; Cooke **52**, 221*; **15**, 654*; Massee **37** (1897, 139); **7**, 240; **102** (V, 419); Barnes **73** (2, XVI, 28); Vize Exs. 144; **74** (VII, 143*) and **28** (XVII, 221) as *Aspergillus glaucus*; *Farinaria sulphurea* Sowerby in **42**, t. 379, 1803. On old plants, etc.
For other British species of *Aspergillus* which produce perithecia see G. Smith, *An Introduction to Industrial Mycology*, 1938.
— **insigne** Wint. Massee & Salmon **33** (XV, 331, 1901 and XVI, 67). On dung.
— **lateritium** Mont. B. & Br. **19**, No. 1925, 1881; Cooke **14** (X, 51, 1881); **37** (1897, 139); **7**, 240. On stale bread, etc.
— **microsporum** Massee & Salm. in **33** (XV, 333*, 1901; XVI, 67); Sacc. XVII, 527. On dung, Kew.
— **repens** de Bary. Elizabeth Dale **102** (VII, 215, 1909, morphology); Forbes **75** (XXII, 123, 1924, from the Underground Railway in London).
Magnusia Bartlettii Massee & Salm. in **33** (XV, 333*, 1901; XVI, 71); Sacc. XVII, 531. On dung, Kew.
— **nitida** Sacc. Massee & Salmon **33** (XVI, 69*, 1902). On dung, Surrey.
Microascus nidicola Massee & Salm. in **33** (XV, 350*, 1901); Sacc. XVII, 610. In a bees' nest, Kew.
— **variabilis** Massee & Salm. in **33** (XV, 349*, 1901; XVI, 74); Sacc. XVII, 610. On dung, Kew and Cheshire.
Microeurotium albidum Ghatak gen.nov. in **33** (L, 860*, 1936). Appeared as a contaminant in a culture of *Poronia*.
Pleuroascus Nicholsoni Massee & Salm. gen.nov. in **33** (XV, 330*, 1901); Sacc. XVII, 532. On dung, Kew.
Thielavia basicola Zopf. Massee **35** (1909, 238*) claimed to have found perithecia of this species associated with *Thielaviopsis basicola* (a distinct species: see *Connecticut Exp. Sta. Bull.* 269, 1925); see also **37** (1912, 46*) and **50**, 50.
— **Soppittii** Crossland in **35** (1900, 7*); Sacc. XVI, 807; **7A**, 275*; **7**, 240. On *Carduus*, Yorks.
Zopfia rhizophila Rabenh. Proudlock **23** (XXXIII, 1043, 1927); **22** (Misc. Publ. 70, p. 40, 1929); **78** (1930, 127); **85** (XXVIII, 24; XXIX, 16; XXXI, 14); **31** (LXXXVII, 275); **112**, 112. On *Asparagus*.

ERYSIPHACEAE

There are countless British records of Powdery Mildews. Salmon (**30** and Supplements) has covered the literature up to 1900. See also Massee **50**, 1913. The species recorded as British by Salmon and subsequent workers are included here, and a few of the references to recent literature. Blumer's "Die Erysiphaceen Mitteleuropas" should be consulted.

Many of the names used by Salmon and now almost universally accepted are pre-Friesian, but were not adopted in the *Systema*. It would be very difficult to decide on correct names for the Erysiphaceae if one started from 1823, and the result of the attempt would be great confusion. We have therefore accepted the citations as Salmon gives them, and believe it would be preferable to begin the Nomenclature of the Erysiphaceae with Persoon, 1801.

Erysiphe Cichoracearum DC. Salmon **30**, 193*; **65** (XXX, 342); **56** (XXVII, 941); **32** (III, 109; XXXIV, 194); **23** (XVII, 185; XXXII, 52); **79** (V, 25 and 32; VII, 35; VIII, 25; IX, 43; XI, 48).

— **Galeopsidis** DC. Salmon **30**, 204*; **28** (III, 115); **32** (III, 109).

— **graminis** DC. Salmon **30**, 209*; **33** (XVIII, 320; XIX, 125 and 444); **32** (III, 55 and 109; IV, 217; XXXIV, 180); **103** (II, 109; III, 400; V, 231); **27** (XLI, 159 and 204); **23** (XIX, 618); **79** (II, 30; III, 23; V, 27; XI, 43); **65** (XXX, 328); **85** (XXXI, 13); **66** (CXCVII B, 107; CXCVIII, 87); **67** (1904 and 1905).

— **Polygoni** DC. Salmon **30**, 174*; **28** (VI, 274); **24** (XVII, 106; XVIII, 294; XIX, 91); **76** (III, 38); **65** (XXX, 338); **37** (1918, 17); **56** (XXVII, 938); **25** (XXVII, 16); **80**, 99; **79** (vols. I, III, IV, VII, XI, XII, XIII); **85** (XXII, 487; XXXIII, 19; XXXVII, 19); **23** (XV, 510) as *E Martii*.

— **tortilis** (Wallr.) Fr. Salmon **30**, 213*.

Microsphaera Alni (Wallr.) Wint. var. **extensa** (Cooke & Peck) Salm. *Oidium* stage recorded **64** (XXXVI, 92, 1922). Neither Salmon nor Blumer reports it for Europe.

— **Astragali** (DC.) Trev. Salmon **30**, 127*.

— **Baumleri** P. Magn. Salmon **30**, 170*, Scotland.

— **Berberidis** (DC.) Lév. Salmon **30**, 123*.

— **Euonymi** (DC.) Sacc. Salmon **30**, 125; **79** (II, 32; V, 31).

— **Grossulariae** (Wallr.) Lév Salmon **30**, 157*; **23** (IV, 202, 1897; VIII, 1; XIV); **24** (XII, 205; XXX, 340); **56** (XXV, 145); **77** (1924, 117); **79** (I, 30; V, 26; X, 38; XI, 51); **85** (XVI, 298).

— **Mougeotii** Lév. Salmon **30**, 159*.

Phyllactinia corylea (Pers.) Karst. Salmon **30**, 224*; **23** (XV, 509).

Podosphaera leucotricha (Ell. & Ev.) Salm. in **30**, 40*, Britain not listed; **23** (XV, 510; XVII, 185 and 890); **25** (XXV, 273; XXXIV, 97); **32** (XXXIV, 180); **65** (XXX, 328); **56** (XXVI, 737); **79** (I, 29; IV, 5; V, 26; XI, 50 and 55); **85** (XXVII, 87); **104** (II, 100; III, 160; VIII, 283; X, 271; XII, 57); **23** (XIV, 357 and 417) as *Sphaerotheca Mali* Burr.

— **Oxyacanthae** (DC.) de Bary. Salmon **30**, 29*; **23** (XV, 441; XVII, 652); **56** (XXVII, 940); **65** (XXX, 338); **79** (V, 31); **28** (III, 115 and 366; IV, 325) as *P. myrtillina*.

— **Oxyacanthae** var. **tridactyla** (Wallr.) Salm. in **30**, 36*.

Sphaerotheca Euphorbiae (Cast.) Salm. Recorded **28** (XI, 7 and XXII, 10) as *S. tomentosa* Otth, on *Euphorbia*, at two forays.

— **Humuli** (DC.) Burrill. Salmon **30**, 45*; **24** (XII, 205); **23** (XVII, 185; XX, 960 and 1071; XXII, 137, XXVIII, 150 and 262); **32** (III, 109); **34** (III, 93; XVII, 129); **56** (XXV, 132; XXVII, 941); **65** (XXX, 338); **66** (CXCVII B, 7); **79** (III, 25; IV, 6; V, 26; X, 39; XI, 53); **85** (1923 and 1927 to 1936); **103** (II, 327; VII, 473; VIII, 455; XII, 269); **23** (III, 291, 1896; V, 199; XIII, 498; XIV, 295) as *S. Castagnei* Lév.

— **Humuli** var. **fuliginea** (Schlecht.) Salm. in **30**, 49*; **32** (III, 109).

Sphaerotheca mors-uvae (Schwein.) Berk. & Curt. First record for Europe by Massee **31** (Apr. 25, 1900*) from Antrim, Ireland; Salmon **30** A, 93, 1902; **56** (xxv, 139*, 1900; xxvi, 778; xxvii, 596); **5**, 146*; **93**, 162; **22** (xxvii, 38); **23** (1901, 1906–1909, 1916); **24** (xii, 205); **25** (iii, 17; vii, 479; xxix, 188; xxxiv, 97); **34** (i, 177); **49** (i, 45; iii, 83); **65** (xxxvi, 1; xxx, 338); **79** (i, iv, x, xi); **85** (1907–1913, 1923, 1938); **87** (vi, 67); **96** (ii, 106; iii, 130); **103** (ii, 187).

— **pannosa** (Wallr.) Lév. Salmon **30**, 65*; **23** (v, 198; xiv, 357 and 744); **32** (xxxiv, 180); **56** (xxi, 84; xxvii, 44 and 939); **65** (xxx, 338); **79** (i, 31; v, 31; xi, 58); **80**, 111; **104** (vii, 245).

— **pannosa** var. **Persicae** Woronich. **65** (xxx, 338); **79** (iii, 24; v, 30; xi, 52); **85** (xxvi, 165; xxxiii, 20; xxxv, 22).

Uncinula Aceris (DC.) Sacc. Salmon **30**, 90*; **70** (xxi, 396); **76** (iii, 38).

— **clandestina** (Biv.-Bern.) Schroet. Recorded by Massee **37** (1897, 138) as *U. Bivonae*, Kew. Salmon **30**, 97, states that this is the only British record, and that he found no specimen.

— **necator** (Schwein.) Burrill. Salmon **30**, 99*; **65** (xxx, 341); **79** (ii, 31; v. 30; vii, 24; xi, 51); **85** (xxvii, 87). Many early records as *Oidium Tuckeri* and *U. spiralis*.

— **prunastri** (DC.) Sacc. Salmon **30**, 95*.

— **Salicis** (DC.) Wint. Salmon **30**, 81*.

PERISPORIACEAE

Antennaria ericophila Link ex Fr. Recorded at Baslow Foray, **28** (iii, 146, 1910). These records of *Antennaria* are all questionable. The generic name is invalid for fungi. See **102** (xv, 483).

— **laevigata** Corda. Massee **37** (1897, 139). On *Betula*, Kew.

[— **pinophila** Nees and *A. pithyophila* are recorded, but Lindau places them both in the Imperfecti as *Hormiscium pinophilum*.]

— **semi-ovata** Berk. & Br. in **19**, No. 784*, 1854; Sacc. i, 82; Cooke **15**, 628*. On *Dryopteris*, Bath. Berkeley thought it a form of *Capnodium*.

Asteridium juniperinum (Cooke) Sacc. in *Syll.* ix, 436; *Asterina* Cooke in **14** (xvi, 77, 1888). On *Juniperus*, Scotland, together with *Antennaria pinophila*.

Irene calostroma (Desm.) von Hohnel. Recorded **28** (xxii, 10, 1938). On *Rubus*, Killarney Foray, 1936.

Lasiobotrys Lonicerae Kunze ex Fr. Greville **39**, t. 191, 1826; Berk. **20**, 325; **31** (Dec. 6, 1851); B. & Br. **19**, No. 661*, 1852; Cooke **15**, 644*; **56** (xxvii, 372); **89**, 49*; **7**, 241; Berk. Exs. 48; Cooke Exs. 463. On *Lonicera*.

Meliola Niessleana Wint. A. Lorrain Smith **28** (iii, 41, 1908). On *Vaccinium* in Scotland.

Perisporium Arundinis Desm. Berk. **19**, No. 220, 1841; Cooke **15**, 644. On "reeds".

— **funiculatum** Preuss. Crossland **7** A, 304, 1904; **7**, 241. On old cloth, Yorks.

— **princeps** Berk. in **18**, 403, 1860; Sacc. i, 57; Cooke **15**, 643; Berk. Exs. 287. On wood, Norths.

— **vulgare** Corda. B. & Br. **19**, No. 1103, 1865; Cooke **15**, 644*; Bucknall **46** (v, 131*, 1887); Stevenson **13**, 351; **35** (Oct. 1893); **37** (1897, 139); **7**, 241; Vize Exs. 83; Cooke Exs. 699, 700 and ii, No. 289; *Sporormia secedens* Bucknall in **46** (v, 46*, 1886). On old cloth, wood, etc.

ENGLERULACEAE

[**Schiffnerula pulchra** (Sacc.) Petrak. Only the bulbils, called *Coniothecium Questieri* Desm. and other names, known in Britain.]

CAPNODIACEAE

All entries except the first are based on old and dubious records.

Adelopus balsamicola (Peck) Theiss. Wilson and Waldie **28** (XIII, 152, 1928). On *Abies* in Scotland and *Pseudotsuga* in Devon.
Apiosporium Abietis Cooke in **14** (IX, 94, 1881). On twigs of living *Picea*, Scotland. Compiled by Saccardo first as *Meliola* (*Syll.* I, 69) then as *Limacinia* (XIV, 474). Specimen not found in Herb. Kew.
Capnodium australe Mont. W. G. Smith **36** (*Proc.* 1880-2, 28). On conifers in Britain.
[— **Citri** Berk. & Desm. Cooke **14** (v, 64, 1876). On leaves of *Citrus*, Exeter. Cooke's record must refer to pycnidia, and not to the perithecial *Aithaloderma Citri* (Berk. & Desm.) Woronich.]
— **elongatum** Berk. & Desm. in **56** (IV, 251*, 1849); Sacc. I, 75; B. & Br. **19**, No. 900, 1859; Cooke **15**, 933*; **56** (1879, 116); Massee **50**, 52. On *Pyrus communis*, Cornwall.
[— **Footii** Berk. & Desm. in **56** (IV, 254*, 1849); Cooke **15**, 933; Sacc. I, 80; **81**, 195; **23** (XIV, 417); **89**, 180; **50**, 52; Cooke Exs. 595 and II, No. 292; Vize Exs. 395. On leaves. This is the Type of *Microxyphium* (Sacc.) Speg. (*Physis* IV, 293), and is pycnidial.]
— **Juniperi** Phill. & Plowr. in **14** (XIII, 75, 1885); Sacc. *Addit. I–IV*, 21. On twigs of *Juniperus*, Scotland, with *Antennaria pithyophila*.
— **salicinum** Mont. Cooke **14** (I, 175, 1873); **37** (1897, 139); **7**, 241; **5**, 165; Massee **50**, 51; **112**, 112; Cooke Exs. 596 and II, No. 291; Vize Exs. 100. On leaves of *Salix*. This is the type species of the genus.
— **Tiliae** Sacc. Massee **37** (1897, 139); **7**, 241. On leaves of *Tilia*, Kew and Yorkshire. No British specimen was found in Herb. Kew.
Orbicula tartaricola (Nyl.) Cooke gen.nov. in **15**, 926, 1871; Sacc. I, 38; *Sphaeria* Nyl. apud Leighton in *Ann. Mag. Nat. Hist.* Ser. 3, XIX, 408*, 1867 and **45** (XXVII, 159*, 1870); Keissler **119**, 267. On a lichen, Dolgelly, Wales.

SPHAERIALES

SPHAERIACEAE: ALLANTOSPORAE

The arrangement of the Allantosporae by von Hohnel **102** (XVI, 128, 1918) has provided the basis for most subsequent work. See also Wehmeyer in *Amer. J. Bot.* XIII, 575, 1926. Where possible the type-host is given for each species of *Valsa*, not to suggest that a species is host-limited, but as a guide to collectors.

Calosphaeria dryina (Currey) Nits. in *Pyr. Germ.* p. 94; Sacc. I, 97; *Sphaeria* Currey in **45** (XXII, 278*, 1858); *Valsa* B. & Br. in **19**, No. 850, 1859; Cooke **15**, 824; Massee **14** (XV, 117). On *Quercus*.
— **minima** Tul. F. A. Mason **35** (1921, 216); **115**, 40. Yorks, host not given.
— **pulchella** (Pers. ex Fr.) Schroet. *Circinostoma* Gray in *Nat. Arr. Brit. Pls.* p. 521, 1821; *Cryptosphaeria* Greville in **39**, t. 67, 1824; Berk. **20**, 251 as *Sphaeria*, but not Currey **45** (XXII, 280*), teste Tul.; Cooke **15**, 828 as *Valsa*; Massee **14** (XV, 117); Cooke Exs. II, No. 680; Plowr. Exs. I, No. 48; *Calosphaeria princeps* Tul. in **114** (II, 108, 1863). On *Prunus*. Early records included *C. Wahlenbergii*.
[— **vibratilis** (Fr.) Nits. See *Massariella vibratilis*.]
— **Wahlenbergii** (Desm.) Nits. Massee **14** (XV, 117, 1887) as *C. pusilla* (see Introduction, p. 129). On bark, Batheaston; on *Betula* (see Appendix I).
Coronophora angustata Fuckel. Hawley **28** (VIII, 230); Bucknall **46** (IV, 202, 1885) as *Valsa*. On *Betula* and *Fagus*.
— **gregaria** (Lib.) Fuckel. Massee **14** (XV, 70, 1887); Bucknall **46** (V, 47*, 1886) as *Valsa*. On twigs near Bristol.

Cryptosphaeria eunomia (Fr.) Fuckel. Chesters **113** (1938, 181*); most British records based on *Cryptosphaeria millepunctata* Greville in **51**, 360, 1824 and **39**, t. 201, 1826; Sacc. I, 182; Cooke **14** (XI, 76); Massee **14** (XVIII, 10); **7**, 233; *Sphaeria millepunctata* Grev. in **39**, Index; Cooke **15**, 885; Berk. Exs. 84; Cooke Exs. II, No. 245; Plowr. Exs. I, No. 83; Grove **27** (LXVI, 354) as *Cladosphaeria eunomioides* (Otth) Nits.; *Sphaeria corticis* Sowerby in **42**, t. 372, 1802; Currey **45** (XXII, 328*). Common on *Fraxinus*. The spores may become septate. See Wehmeyer, *Amer. J. Bot.* XIII, 237, 1926.

Greville based his genus *Cryptosphaeria* on *C. Taxi* (Sow.) Grev. in **39**, t. 13, 1823. This is now called *Diplodia Taxi* (Sow. ex Fr.) de Not.; see Grove **1** (II, 60). Greville subsequently placed various fungi in *Cryptosphaeria*; twenty species including *C. millepunctata* are given in **51**, 359–63, 1824. He finally (**39**, Index) discarded the genus.

— **ocellata** (Fr.) Ces. & de Not. Massee **14** (XVIII, 10); Berk. **20**, 268, 1836 as *Sphaeria*; Currey **45** (XXII, 324*); Cooke **15**, 886; *S. brevis* Sowerby in **42**, t. 394, 1803. On *Fraxinus, Salix*, etc. The species is doubtful, the British records more so.

Cryptovalsa elevata (Berk.) Sacc. in *Syll.* I, 191; Currey **45** (XXII, 274*, 1858) as *Sphaeria*; *Diatrype* B. & Br. in **19**, No. 844, 1859; *Eutypa* Cooke in **15**, 801. On *Euonymus*, Batheaston. The type collection of *Sphaeria elevata* Berk. in **21** (1845, 298) was from Australia; the British fungus does not agree with the type and is probably a *Diatrypella*.

— **protracta** (Pers. ex Fr.) Ces. & de Not. **37** (1936, 65); Bucknall **46** (V, 127* and 131, 1887) as *C. Nitschkei* Fuckel. On *Fraxinus*.

Diatrype Berberidis Cooke in **14** (XIV, 14, 1885); Sacc. *Addit. I–IV*, 35; Bucknall **46** (V, 51, 1886); Berlese **98** (III, 87*). On *Berberis*, Bristol.

— **Brassicae** Cooke in **14** (XIII, 100, 1885); Sacc. *Addit. I–IV*, 34; Bucknall **46** (V, 51, 1886); **14** (XV, 69). On *Brassica*. Berlese **98** (III, 104) found the type specimen decayed and useless.

— **bullata** (Hoffm. ex Fr.) Fr. Cooke **15**, 812; Massee **14** (XV, 68); **7**, 222; Plowr. Exs. I, No. 34; Vize Exs. 158; Cooke Exs. 485 and II, No. 674; Hooker **92**, 5, 1821 as *Sphaeria*; Berk. **20**, 241; *S. depressa* Bolton in **111**, t. 122, 1789. On *Salix*.

— **disciformis** (Hoffm. ex Fr.) Fr. Tul. **114** (II, 95); Cooke **15**, 812; **14** (XV, 68); Plowr. Exs. I, No. 33; Cooke Exs. 389 and II, 218; Vize Exs. 159; Hooker **92**, 5, 1821 as *Sphaeria*; Berk. **20**, 241; Currey **45** (XXII, 268*); *Stromatosphaeria* Greville in **51**, 357, 1824; **39**, t. 314. On *Fagus*, etc.

— **stigma** (Hoffm. ex Fr.) Fr. Cooke **15**, 811, 1871; Massee **14** (XV, 68); Chesters **113** (1936, 129*); Cooke Exs. 240 and II, No. 217; Vize Exs. 285; Plowr. Exs. I, No. 32; Hooker **92**, 5, 1821 as *Sphaeria*; Berk. **20**, 241; Currey **45** (XXII, 271*); Greville **51**, 356, 1824; *Stromatosphaeria* Greville in **39**, t. 223, 1826; *Stictosphaeria Hoffmanni* Tul. in **114** (II, 49, 1863); first British record apparently *Sphaeria decorticans* Sowerby in **42**, t. 137, 1798, then perhaps as *S. Kirbii* in **42**, t. 371, 1802, and *S. cinerea* in **42**, t. 373, 1802; Hooker **92**, 5, 1821 as *S. undulata* Pers.; Greville **39**, t. 223, 1826; Berk. **20**, 241; Cooke **15**, 814. Common on bark and wood, and should no doubt include many reputed species of *Eutypa*.

Diatrypella aspera (Fr.) Nits. Cooke **15**, 810, 1871 as *Diatrype*; Massee **14** (XV, 68); Bucknall **46** (III, 69); **7**, 221; Berk. **20**, 242, 1836 as *Sphaeria*. On *Fagus*, etc. See Croxall **28** (XXII, 307, 1939) on the genus *Diatrypella*.

— **discoidea** Cooke & Peck in Thüm. Reported by Massee & Crossland **7**, 221, 1905 as *Diatrype*. On *Betula*, Yorks.

— **exigua** Wint. Rea & Hawley **71** (XXXI, Part 13, p. 7, 1912). On *Salix*, Clare Island.

— **favacea** (Fr.) Ces. & de Not. Chesters **113** (1935, 97*); Plowr. Exs. III, No. 20; Cooke **15**, 810, 1871 as *Diatrype*; **14** (XV, 68); Berk. **20**, 242, 1836 as *Sphaeria*; **19**, No. 17, 1837. On *Betula*. Chesters & Croxall **113** (1937, 158) consider that *D. verruciformis* and *D. Tocciaeana* probably belong here.—*D. favacea* is considered the type species of the genus.

Diatrypella nigro-annulata (Grev.) Nits. in *Pyren. Germ.* p. 81; Sacc. I, 202; *Stromatosphaeria* Greville in **51**, 358, 1824 (on *Tilia*); Massee **14** (xv, 68) as *Diatrype*; Berk. **20**, 248, 1836 as *Sphaeria angulata* Fr.; B. & Br. **19**, No. 848, 1859 as *Valsa angulata*; Cooke **15**, 811 as *Diatrype angulata*, "on beech, laburnum, birch and lime". Von Hohnel (*Fragm. Myk.* 887) considers *D. nigro-annulata* a small form of *D. verruciformis*. Fries's name "*angulata*" should be used, if this species be distinct.

— **quercina** (Pers. ex Fr.) Cooke in **27** (IV, 99*, 1866); Chesters & Croxall **113** (1937, 156*); Cooke **15**, 810 as *Diatrype*; Massee **14** (xv, 68); Tul. **114** (II, 97); Vize Exs. 491; Cooke Exs. 242 and II, Nos. 219, 678; Plowr. Exs. I, No. 31. Greville's record as *Stromatosphaeria* (**51**, 358, 1824) may have referred to this species, at least in part; but see *Pseudovalsa longipes*. Common on *Quercus*.

— **Rhois** (Schwein.) Ell. & Ev. Massee **37** (Add. Ser. v, 148, 1906). On *Rhus*, Kew.

— **Tocciaeana** de Not. Chesters & Croxall **113** (1937, 158) redescribed it but considered it probably a form of *D. favacea*; Massee **14** (xv, 68) as *Diatrype*; Vize Exs. 287; Cooke **14** (I, 155, 1873) and Stevenson **40** (VII, 89) as *Diatrype verruciformis* var. *Tocciaeana*; Cooke Exs. 483. On *Alnus*.

— **verruciformis** (Ehrh. ex Fr.) Nits. Chesters & Croxall **113** (1937, 157*) redescribed it, but consider it probably a form of *D. favacea* (see also Tul. **114** (II, 99, 298)); Berk. **20**, 242, 1836 as *Sphaeria*; Currey **45** (XXII, 270*); Massee **14** (xv, 68) as *Diatrype*; Cooke Exs. 483 and II, No. 220; Vize Exs. 286; Plowr. Exs. II, No. 20; first British record presumed to be *Sphaeria parallela* Sowerby in **42**, t. 394, 1803. Type on *Corylus*.—Cooke **27** (IV, 100, 1866) mentions "*D[iatrypella] affinis*" (a nomen nudum) which he later, **14** (XIV, 14), referred to *D. verruciformis*, and Massee **14** (xv, 68) called it "*Diatrype verruciformis* var. *affinis* Cooke". On *Sambucus*.

Enchnoa infernalis (Kunze ex Fr.) Fuckel. Massee **14** (XVIII, 10); **37** (1936, 66); *Sphaeria glis* Berk. & Currey apud B. & Br. in **19**, No. 884, 1859; Currey **45** (XXII, 314*); Cooke **15**, 884; Plowr. Exs. III, No. 56. On *Quercus*.

— **lanata** (Fr.) Fr. Massee **14** (XVIII, 10); Berk. **19**, No. 185, 1841 as *Sphaeria*; Cooke **15**, 884. On *Betula*.

Eutypa Acharii Tul. in **114** (II, 53*, 1863); Cooke **15**, 798*; Massee **14** (xv, 120); Bucknall **46** (III, 68); **7**, 224; Vize Exs. 588; Plowr. Exs. I, No. 22; Cooke Exs. 365; *Sphaeria decomponens* Sowerby in **42**, t. 217, 1799; Berk. **20**, 267 as *S. eutypa*; Currey **45** (XXII, t. 47); Berk. Exs. 178. Common on dead branches.

— **aspera** (Nits.) Fuckel. B. & Br. **19**, No. 1726, 1878; Cooke **14** (VI, 128, 1878; VII, 80); Massee **14** (xv, 121); **7**, 224. On wood.

— **flavovirens** (Pers. ex Fr.) Tul. in **114** (II, 56*, 1863); Cooke **15**, 799; **7**, 225; Vize Exs. 283; Cooke Exs. 368 and II, No. 469; Plowr. Exs. I, No. 23; Berk. **20**, 240 as *Sphaeria*; Currey **45** (XXII, 268*); *Stromatosphaeria* Greville in **39**, t. 320, 1828; *Sphaeria multiceps* Sowerby in **42**, t. 394, 1803; *Stromatosphaeria multiceps* Grev. in **51**, 356. Common on wood and bark. Hoffmann's specific epithet "*flavovirescens*" is often used, but Fries adopted "*flavovirens*".

— **hydnoidea** (Fr.) von Hohnel. Foray records in Appendix I; B. & Br. **19**, No. 1814, 1879 as *Radulum aterrimum* Fr.; see Rea **2**, 641. On *Betula*. The supposed perithecia have not been reported in Britain. The fungus is sometimes called *Eutypa aterrima*. See Lind, *Danish Fungi* p. 553*.

— **lata** (Pers. ex Fr.) Tul. in **114** (II, 55, 1863); Cooke **15**, 799; Massee **14** (xv, 121); **7**, 224; Vize Exs. 284; Cooke Exs. 375 and II, Nos. 470, 471; Plowr. Exs. II, No. 13; Hooker **92**, 6, 1821 as *Sphaeria*; Berk. **20**, 245; Currey **45** (XXII, 274*); *S. fuliginosa* Sowerby in **42**, t. 373, 1802. On wood.

— **leioplaca** (Fr.) Cooke in **15**, 800, 1871; Massee **14** (xv,121); Cooke Exs. 366; Plowr. Exs. II, No. 14; Berk. **20**, 245, 1836 as *Sphaeria*; Currey **45** (XXII, 273*); *S. immersa* Sowerby in **42**, t. 394, 1802. On wood.

— **leprosa** (Fr.) Sacc. Currey **45** (XXII, 271, 1858) as *Sphaeria*; B. & Br. **19**, No. 1986, 1882; Cooke **14** (XI, 16). On *Tilia*, Penzance. Berlese **98** (III, 50) considered it the same as *E. ludibunda*.

Eutypa ludibunda (Sacc.) Sacc. Berlese **98** (III, 69, 1902) states that Cooke Exs. 361 and 362, issued as *Valsa stellulata*, are this species; Rilstone **27** (1935, 102) as *V. ludibunda* on *Ligustrum*.

— **maura** (Fr.) Sacc. Massee **14** (xv, 121, 1887). On wood, Highgate.

— **prorumpens** (Wallr. in Fr.) Sacc. Massee **14** (xv, 121, 1887). On *Pyrus Aucuparia*, Kings Cliffe. Berlese **98** (III, 72) transferred the epithet to *Eutypella*, but considered the species to be confined to *Viburnum Opulus*.

— **Rhodi** (Nits.) Fuckel. Cooke **15**, 800, 1871; Massee **14** (xv, 121); Bucknall **46** (IV, 201). On *Rosa*.

— **scabrosa** (Bull. ex Fr.) Fuckel. Cooke **15**, 800, 1871; Massee **14** (xv, 121); Bucknall **46** (III, 68); Berk. **19**, No. 171, 1841 as *Sphaeria*. On *Ulmus* and *Acer*.

— **spinosa** (Pers. ex Fr.) Tul. in **114** (II, 58, 1863); Cooke **15**, 799, 1871; Massee **14** (xv, 121); **7**, 224; Cooke Exs. II, No. 675; Berl. **98** (III, t. 675); Berk. **20**, 244, 1836 as *Sphaeria*; Currey **45** (XXII, 274*). On branches.

— **Ulicis** (Fr.) Sacc. Massee **14** (xv, 69 and 121); **7**, 225; B. & Br. **19**, No. 599, 1851 as *Sphaeria*; Cooke **15**, 817 as *Diatrype*. On *Ulex*.

— **velutina** (Wallr.) Sacc. Phill. & Plowr. **14** (XIII, 75, 1885); Grove **27** (XXIII, 131, 1885). On *Acer*.

Eutypella Ailanthi (Sacc.) Sacc. Massee **14** (xv, 70, 1887) as *Valsa*. On *Ailanthus*, Kew.

— **microspora** (Cooke & Plowr.) Sacc. in *Syll.* I, 155; Berl. **98** (III, 58*); *Valsa* Cooke & Plowr. in **14** (VII, 82, 1879); Massee **14** (xv, 70); Plowr. Exs. III, No. 23. On *Fagus*, Norfolk.

— **prunastri** (Pers. ex Fr.) Sacc. Massee **31** (Sept. 27, 1902); **5**, 171*; **89**, 111; **56** (XXVI, 742*); **23** (IX, 261; XV, 690); **56** (XXVI, 742*; XXVII, 691, 736 and 1152); **24** (XII, 208); **34** (X, 254); Hooker **92**, 6, 1821 as *Sphaeria*; Berk. **20**, 246, 1836; Currey **45** (XXII, 275); Berk. Exs. 29; Cooke **15**, 821 as *Valsa*; **14** (xv, 70); Cooke Exs. 237; Plowr. Exs. I, No. 41. On *Prunus spinosa*.

— **Sorbi** (Schmidt ex Fr.) Sacc. Foray 1930 (see Appendix I); Massee **14** (xv, 70, 1877) as *Valsa*. On *Pyrus Aucuparia*.

— **stellulata** (Fr.) Sacc. Berk. **20**, 246, 1836 as *Sphaeria*; Currey **45** (XXII, 275*); Berk. Exs. 79; Cooke **15**, 821 as *Valsa*; Massee **14** (xv, 70); Plowr. Exs. I, No. 42; Cooke Exs. 382 and II, No. 677; Vize Exs. 164; see Berlese **98** (III, 69). On *Ulmus* (and *Acer*?). See *Eutypa ludibunda*.

— **tetraploa** (Berk. & Curt.) Sacc. B. & Br. **19**, No. 854, 1859 as *Valsa*; Cooke **15**, 827; Massee **14** (xv, 70); Bucknall **46** (II, 217). On sticks.

Nitschkia cupularis (Pers. ex Fr.) Karst. Massee **14** (XVI, 34); **7**, 226; Fitzpatrick **100** (xv, 32, 1923); *Cucurbitaria* Gray in *Nat. Arr. Brit. Pls.* p. 519, 1821; Cooke **15**, 842; Bucknall **46** (v, 51); Plowr. Exs. I, No. 57; Cooke Exs. II, No. 561; Vize Exs. 161; Berk. **20**, 254 as *Sphaeria*; Currey **45** (XXII, 281* and XXV, 249, two fungi found present); Tul. **114** (II, 244; III, 82, 84); Plowr. Exs. I, No. 63 as *Sphaeria tristis*. As Tulasne first noted, it is always associated with *Nectria cinnabarina*; see also **102** (XXV, 362). On *Prunus*, etc. Berlese **98** (III, 23*) figured what he considered to be *N. cupularis* and *N. tristis* from Britain.

— "**Fuckelii** Nits.". Fitzpatrick **100** (xv, 31) used this name for two examples of Berk. Exs. 174, issued as *Sphaeria acervata*. But the name is a synonym of the preceding: Nitschke renamed *cupularis* "*Fuckelii*" and transferred it to *Nitschkia*. Two distinct species are not recognized by British workers.

Peroneutypa heteracantha (Sacc.) Berl. One of the commoner Pyrenomycetes on bark in Britain, but it has been recorded as *Peroneutypa* only in recent Foray lists; A. Lorrain Smith **27** (XLI, 257, 1903) as *Valsa*. Earlier collections were placed under various names, e.g. on *Sambucus* as *Valsa syngenesia* (B. & Br. **19**, No. 847; Cooke **15**, 822; see Cooke **27** (IV, 99) as *Diatrype*), on *Acer Pseudoplatanus* as *Diatrype hystrix* (B. & Br. **19**, No. 840, 1859; Cooke **15**, 812); Currey had it on *Ulmus* under the name *Diatrype corniculata* (see next entry) and Cooke incorrectly based the first British records (**27** (IV, 101*, 1866); **15**,

825, 1871) of *Valsa ceratophora* on *Ulmus* on the same fungus. The earliest correct specific epithet can hardly be ascertained until Persoon's herbarium is examined.

[**Peroneutypa corniculata** (Ehrh.?) Berl. in **98** (III, 80*, 1902). Three different species have been determined in Britain as *Sphaeria corniculata* Ehrh. *Cryptosphaeria corniculata* (Ehrh.) Greville in **51**, 358, 1824, "on dead branches of various trees", is a *Diaporthe*, perhaps *D. eres*. *Diatrype corniculata* (Ehrh.) Berk. & Br. in **19**, No. 845, 1859 in a *Eu-Valsa* on *Quercus*, with stromata resembling those of *Valsa ceratophora*, but with longer ascospores, up to 14 μ. Finally Currey collected specimens, on corky *Ulmus*, with ascospores up to 6 μ long. This must have been the collection forwarded by Cooke to Berlese on which the latter founded the species *P. corniculata*. This fungus is the same as the preceding. Other entries of "*corniculata*" are Hooker **92**, 6; Berk. **20**, 247; Cooke **15**, 813; **14** (XV, 69); **7**, 222.]

Quaternaria abnormis (Fr.) Berl. & Vogl. *Valsa* Cooke in **14** (XIII, 39, 1884); Massee **14** (XV, 116). On branches, Shere.

— **dissepta** (Fr.) Tul. in **114** (II, 106, 1863); Rhodes **108** (1933, 49); Berk. **20**, 249, 1836 as *Sphaeria*; **19**, No. 173, 1841; Cooke **15**, 823 as *Valsa*; Massee **14** (XV, 116); Cooke Exs. II, No. 230; Plowr. Exs. I, No. 44; *Eutypa* Berl. in **98** (III, 48); *Sphaeria saturnus* Sowerby in **42**, t. 216, 1799; *Sphaeria stipata* Currey in **66** (CXLVII, 545*, 1858); **45** (XXII, 274*); *Diatrype stipata* B. & Br. in **19**, No. 843; **19**, No. 970, 1861; Cooke Exs. 239; B. & Br. **19**, No. 862* in error as *Valsa hypodermia*; Broome Exs. in Rabenh. *Herb. Mycol.* II, No. 320. Common on *Ulmus*, recorded probably in error on other hosts.

— **quaternata** (Pers. ex Fr.) Schroet. **37** (1936, 66); Berk. **20**, 251, 1836 as *Sphaeria*; Currey **45** (XXII, 281*); Cooke **15**, 828 as *Valsa*; Massee **14** (XV, 116); **7**, 223; Cooke Exs. 248 and II, Nos. 221, 224; Vize Exs. 167; Plowr. Exs. I, No. 49; Tul. **114** (II. 104) as *Q. Persoonii*. On *Fagus*.

Valsa Abietis (Fr.) Fr. [Monostichae]. Cooke **15**, 825, 1871; Massee **14** (XV, 71); Cooke Exs. II, No. 484; Plowr. Exs. II, No. 29; Berk. **20**, 249, 1836 as *Sphaeria*. On *Abies* [type host].

— **abrupta** Cooke in **14** (VII, 83, 1879) [Monostichae]; Sacc. I, 143; Massee **14** (XV, 70). On *Salix*, Shere. See **105** (XVII, 126).

— **ambiens** (Pers. ex Fr.) Fr. [Circinatae]. Tul. **114** (II, 175); Cooke **15**, 826; Massee **14** (XV, 71); Chesters & Croxall **113** (1937, 154*); **104** (XI, 205; XIII? 144); **89**, 120*; **56** (XXVI, CXXVII); Cooke Exs. 256, 487 and II, No. 232; Vize Exs. 163; Plowr. Exs. I, No. 46; **7**, 225 as "*Diaporthe*"; Berk. **20**, 250, 1836 as *Sphaeria*; Berk. Exs. 80; Currey **45** (XXII, 279*) p.p. as *S. tetraspora*. On *Pyrus*, *Rosa*, *Acer*, etc. The following "varieties" have been recorded:

var. **Betulae** Plowr. Exs. II, No. 33.

var. **Carpini** Cooke, Massee **14** (XV, 71).

var. **Coryli** Sacc., Massee **14** (XV, 71); Plowr. Exs. II, No. 30.

var. **Crataegi** Cooke [*Crataegus* is the type host of *V. ambiens*], Massee **14** (XV, 71); see Grove **37** (1923, 4).

var. **Mali** Sacc., Massee **14** (XV, 71); Plowr. Exs. II, No. 31; Cooke Exs. II, No. 472.

var. **Populi** Plowr. Exs. II, No. 32.

var. **Pyri** Cooke, Massee **14** (XV, 71); Cooke Exs. 684.

— **ceratophora** Tul. in **114** (II, 190*) [Monostichae, type host *Quercus*]; Massee **14** (XV, 70); **7**, 222; Cooke Exs. 251; Plowr. Exs. I, No. 45; Berk. **20**, 244, 1836 as *Sphaeria ceratosperma* Tode [ex Fr.] (this is the valid specific epithet for the *Valsa*); Currey **45** (XXII, 292); Cooke **27** (IV, 101*). On trees and shrubs. The following "varieties" are recorded:

var. **acericola** Cooke, Massee **14** (XV, 71).

var. **quercicola** Sacc., Cooke **15**, 825*; Massee **14** (XV, 71).

var. **Rosarum** de Not., Cooke **15**, 825. Massee **14** (XV, 71); Vize Exs. 170; Plowr. Exs. II, No. 28; Cooke Exs. II, No. 483 as *V. Rosarum*.

[var. **Ulmi** Massee **14** (XV, 71). This was *Peroneutypa heteracantha*.]

Valsa ceuthospora Cooke [as "*ceuthospori*"] in **14** (VII, 83, 1879); Sacc. I, 143 [as "*ceuthosporae*"]; Massee **14** (XV, 70); "*V. Laurocerasi*" in **14** (IV, 113); Cooke Exs. II, No. 468. On *Prunus Laurocerasus*. The description in **14** (IV, 113) suggests a *Diaporthe*. See Grove **1** (I, 292).

— **cincta** (Fr.) Fr. [Leucostoma, no type host cited; modern records on *Prunus*]. Grove **27** (XXIV, 131, 1886). On *Prunus*, Warwicks.

— **concamerata** (Currey) Berk. & Br. in **19**, No. 867, 1859; Cooke **15**, 824; Sacc. I, 124; *Sphaeria* Currey in **45** (XXII, 277*, 1858). On *Quercus*. Currey thought it might be a form of *V. ceratophora*.

— **cornicola** Cooke in **14** (VII, 83, 1879) [Circinatae]; Sacc. I, 122; Massee **14** (XV, 71); Bucknall **46** (V, 131). On *Cornus*. See **105** (XVII, 123).

— **coronata** (Hoffm. ex Fr.) Fr. [Monostichae; teste Fries on *Cornus* and *Crataegus*]. Cooke **15**, 825, 1871; Massee **14** (XV, 71); Bucknall **46** (IV, 201); Berk. **20**, 249, 1836 as *Sphaeria*. On *Betula*.

— **Curreyi** Nits. in *Pyr. Germ.* p. 202 [Circinatae]; Sacc. I, 132; Cooke & Plowr. **14** (VII, 83); **13**, 381; Massee **14** (XV, 72); Bucknall **46** (IV, 201); Chesters **113** (1935, 96*); Cooke Exs. II, No. 679; "*Sphaeria Abietis*" in **45** (XXII, 279*). On *Larix* [type host].

— **Cypri** (Tul.) Tul. in **114** (II, 193, 1863) [Circinatae]; Cooke **14** (I, 155, 1873 and VII, 83); Massee **14** (XV, 72); Rhodes **108** (1933, 48) as *V. Ligustri* (Schwein.) Schroet. On *Ligustrum* [type host].

— **decorticans** (Fr.) Fr. [Monostichae, type host *Fagus*]. Hawley **28** (VIII, 229, 1923). On *Carpinus* and *Fagus*.

— **diatrypa** (Fr.) Fr. [Leucostoma, type host *Alnus*]. Recorded **28** (XXII, 3); see Appendix I.

— **Fuckelii** Nits. [Monostichae]. Cooke & Plowr. **14** (VII, 83, 1879); Massee **14** (XV, 71). On *Corylus* [type host], Shere.

— **germanica** Nits. [Circinatae]. Grove **27** (LX, 45 and 171, 1922, on *Salix*); Hawley **28** (VIII, 229, on *Betula*).

— **Hoffmanni** Nits. [Monostichae]. Massee **14** (XV, 71, 1887). On *Crataegus* [type host], Highgate.

— **horrida** Nits. [Monostichae]. Hawley **28** (VIII, 229, 1923). On *Betula* [type host], Sussex.

— **Kunzei** (Fr.) Fr. [Leucostoma]. Cooke **15**, 823; Massee **14** (XV, 70); Cooke Exs. II, No. 672; Plowr. Exs. III, No. 22; B. & Br. **19**, No. 601, 1851 as *Sphaeria*; Currey **45** (XXII, 227*). On *Picea* [type host].

[— **lageniformis** (Sollm.) Currey is *Robergea unica*, a Discomycete.]

— **Laurocerasi** Tul. in **114** (II, 195, 1863) [Leucostoma]; Phill. & Plowr. **14** (VIII, 107, 1880); Massee **14** (XV, 70); Plowr. Exs. III, No. 21. On *Prunus Laurocerasus* [type host]. See *V. ceuthospora* above. Nitschke (*Pyr. Germ.*) considered *V. Laurocerasi* to be *V. cincta*; see also *Flora Italica*.

— **leiphaemioides** Berk. & Curt. Listed by Massee **14** (XV, 71, 1887); **7**, 222. On *Quercus*. This is a North American species imperfectly known to Ellis & Everhart.

— **leucostoma** (Pers. ex Fr.) Fr. [Leucostoma]. Cooke **15**, 822; Massee **14** (XV, 70); **85** (XXI, 367); **112**, 201; Berk. **20**, 248, 1836 as *Sphaeria*; Berk. Exs. 31. On *Prunus* [type host], etc.

— **microstoma** (Pers. ex Fr.) Fr. [Monostichae]. Cooke **15**, 823; Massee **14** (XV, 71); Bucknall **46** (IV, 201); Berk. **19**, No. 20, 1837 as *Sphaeria*; Currey **45** (XXII, 277*). On *Prunus* [type host, recorded by Massee on *Alnus* probably in error].

— **Mulleriana** Cooke in **14** (XIV, 46, 1885); Sacc. *Addit.* I–IV, 27. On *Quercus*, Eastbourne.

— **nivea** (Pers. ex Fr.) Fr. [Leucostoma]. Tul. **114** (II, 181); Cooke **15**, 822; Massee **14** (XV, 70); Plowr. Exs. II, No. 27; Hooker **92**, 6, 1821 as *Sphaeria* (on *Quercus*); Berk. **20**, 248. On *Populus* [type host of Pers.]. See *Valsella polyspora*.

— **oxystoma** Rehm. Cooke **14** (XVI, 77, 1888); W. S. Jones **94** (IV, 221*). On *Alnus*, sometimes injurious.

Valsa pauperata Cooke & Ellis. Massee **14** (xv, 72, 1887). On *Cerasus*, Jedburgh. Doubtless wrongly identified; a North American species, type host *Acer rubrum*.
— **Pini** (Alb. & Schw. ex Fr.) Fr. [Monostichae]. Hawley **28** (viii, 228, 1923). On *Pinus* [type host], Sussex.
— **populina** Fuckel [Circinatae]. Massee **14** (xv, 72, 1887); **7**, 223. On *Populus* [type host *P. italica*], Yorks.
— **querna** (Currey) Berk. & Br. in **19**, No. 856, 1859; Cooke **15**, 828 as "*quernea*"; Massee **14** (xv, 71); Sacc. i, 122 (queried as a *Calosphaeria*); *Sphaeria* Currey in **45** (xxii, 279*, 1858). On *Quercus*.
— **rhodophila** Berk. & Br. in **19**, No. 855, 1859 [Circinatae]; Sacc. i, 136; Cooke **15**, 828; **14** (xv, 72); Bucknall **46** (iii, 268). On *Rosa*.
— **salicina** (Pers. ex Fr.) Fr. [Circinatae]. Tul. **114** (ii, 177); Cooke **15**, 827; **14** (xv, 72); Cooke Exs. 377; Plowr. Exs. i, No. 47; Berk. **20**, 250, 1836 as *Sphaeria*; *S. tetraspora* Currey p.p. in **45** (xxii, 279*); B. & Br. **19**, No. 859, 1859 as *V. tetraspora*. On *Salix* [type host]. See *V. ambiens*, *Diaporthe salicella* and *Cryptodiaporthe salicina*.
— **Schweinitzii** Nits. [Monostichae]. Massee **14** (xv, 71, 1887). On *Salix* [type host], Shere.
— **sordida** Nits. [Circinatae]. Grove **27** (1923, 4). On *Populus* [type host], locality not stated.
— **subseriata** Cooke in **14** (xiv, 47, 1885) [Circinatae]; Sacc. *Addit. I–IV*, 29; **14** (xv, 72). On *Fagus*, Shere.
— **Syringae** Nits. [Monostichae]. Massee **14** (xv, 71). On *Syringa* [type host], Scotland. Wehmeyer **28** (xvii, 257) found Cooke Exs. 492 to be *Diaporthe eres*.
Valsella clypeata Fuckel. Phill. & Plowr. **14** (x, 72, 1881) as *Valsa*. On *Rubus*, Scotland. Petrak **102** (1923, 227) regards each species of *Valsella* as a polysporous state of some species of *Valsa* section *Leucostoma*.
[— **polyspora** (Nits.) Sacc. Nitschke cited Currey's figures of "*Sphaeria nivea*" in **45** (xxii, 276*, 1858) as probably this species. Currey **45** (xxv, 247) stated that his figures were based on Scler. Suec. No. 76. Cooke proposed var. *polyspora* of *Valsa nivea* in **15**, 822.]
— **Salicis** Fuckel. Recorded **108** (1930, 111) as *Valsa*; **115**, 38. On *Salix*.

SPHAERIACEAE: HYALOSPORAE

[**Anthostomella pullulans** Bennett. See under Phaeosporae.]
Aporhytisma Urticae (Fr.) von Hohnel. Grove **1** (ii, 189) agrees with Petrak in placing this in the Pyrenomycetes. There are several British records as *Rhytisma*, including Cooke Exs. 392 and ii, No. 456.
Botryosphaeria Dothidea (Fr.) Ces. & de Not. Massee **5**, 174; Cooke **89**, 46* as *B.* "*diplodia*"; **15**, 808 as *Dothidea Rosae* Fr.; **56** (xv, pp. xix and xxix, 1893); Cooke Exs. 235 and ii, No. 234; Vize Exs. 279; Plowr. Exs. i, No. 29; Berk. **20**, 255, 1836 as *Sphaeria Dothidea*; Currey **45** (xxii, 283*); Berk. Exs. 32. On *Rosa* and *Rubus*.
— **melanops** (Tul.) Wint. B. & Br. **19**, No. 1179, 1886 as *Dothidea*; Cooke **15**, 807; Massee **14** (xv, 38) as *B. advena*. On *Fagus*, Jedburgh. See Shear **100** (1936, 476).—A few authors use the generic name *Melanops* where we use *Botryosphaeria*, and *Botryosphaeria* where we use *Gibberella*.
Ceratostomella ampullasca (Cooke) Sacc. in *Syll.* i, 409; Massee **14** (xvii, 73); **32** (xxxii, 180, spore discharge); Chesters **113** (1938, 177*); *Sphaeria* Cooke in **15**, 876*, 1871; *Ceratostoma* Bucknall in **46** (iii, 69, 1880); *Lentomita* Grove in **60** (1886, 76*); **27** (xxiv, 131). On *Quercus* and *Acer*. This is the best-known name of this genuine *Ceratostomella*. It was described earlier as *Sphaeria ligneola* (see under *Lentomita*). Other species often referred to *Ceratostomella* are listed under *Ophiostoma*.
— **cirrhosa** (Pers. ex Fr.) Sacc. Massee **14** (xvii, 73, 1889); Berk. **20**, 267, 1836 as *Sphaeria*; Currey **45** (xxii, 322*, 1859), Cooke **15**, 876; Cooke Exs. ii, No. 684; Plowr. Exs. iii, No. 54. On old wood.

Ceratostomella rostrata (Fr.) Sacc. Massee **14** (XVII, 73, 1889); **7**, 232. On old wood. See *Lentomita ligneola*.

— **vestita** Sacc. Cooke **14** (XIV, 40, 1885); Massee **14** (XVII, 73); Cooke **14** (XVII, 79); Grove **27** (XXIII, 131). On old wood.

— **vestita** var. **varvicensis** Grove in **27** (XXIII, 131, 1885). On wood, Sutton.

Cryptosporella aurea (Fuckel) Sacc. Cooke **15**, 826 as *Valsa*; Massee **14** (XV, 117); *V. amygdalina* Cooke in **27** (IV, 100*, 1866); Cooke Exs. 250. On *Carpinus*.

— **compta** (Tul.) Sacc. Recorded **28** (XIV, 190), Littlehampton Foray, 1928. On *Fagus*.

— **hypodermia** (Fr.) Sacc. Cooke **15**, 829, 1871 as *Valsa*; Massee **14** (XV, 117); Bucknall **46** (V, 51); **7**, 223; Plowr. Exs. III, No. 24; Berk. **20**, 251, 1836 and **19**, No. 21, 1837 as *Sphaeria*. On *Ulmus*. See also *Quaternaria dissepta*.

— **platanigera** (Berk. & Br.) Sacc. in *Syll.* I, 471; *Valsa* B. & Br. in **19**, No. 851*, 1859; Cooke **15**, 827; Massee **14** (XV, 117). On *Platanus*.

— **umbrina** (Jenkins) Jenkins & Wehmeyer in **99** (1935, 888); L. Ogilvie **28** (XVII, 153, 1932) as *Diaporthe*; **100** (XXIV, 485, 1932). On *Rosa*.

Diaporthopsis Angelicae (Berk.) Wehmeyer in **28** (XVII, 290, 1933) and Monog. p. 228; *Sphaeria* Berk. in **19**, No. 28, 1837; Berk. Exs. 88; *S. Berkeleyi* Desm. in Mont.; Cooke **15**, 883; Cooke Exs. 589; Massee **14** (XVI, 12) as *Diaporthe*. There are several other synonyms in continental literature. On Umbelliferae.

— **pantherina** (Berk.) Wehmeyer in **28** (XVII, 292, 1933) and Monog. p. 232; *Sphaeria* Berk. in **19**, No. 23, 1837; Currey **45** (XXII, 285); Cooke **15**, 895; Berk. Exs. 34; Plowr. Exs. III, No. 59; *Diaporthe* Cooke in **14** (VII, 82); **14** (XVI, 13). On *Pteridium*.

Ditopella ditopa (Fr.) Schroet. Rilstone **27** (1935, 102); B. & Br. **19**, No. 631*, 1852 as *Sphaeria*; Currey **45** (XXII, 325*, 1859); Plowr. **31** (June 17, 1899) and Exs. II, No. 70; Cooke **15**, 887 as form *polyspora*; Vize Exs. 181; Cooke Exs. 384 and II, No. 247; *Physalospora fusispora* Cooke in **14** (XVII, 88); Massee **14** (XVIII, 10); Tul. **114** (II, 145) as form of *Cryptospora suffusa*. On *Alnus*.

— **farcta** (Berk. & Br.) Sacc. in *Syll.* I, 450; *Sphaeria* B. & Br. in **19**, No. 631*, 1852; Cooke **15**, 886; Plowr. Exs. II, No. 68; *Physalospora* Cooke in **14** (XVII, 88); Massee **14** (XVIII, 11). On *Ulmus*. Niessl transferred this to *Diaporthe*. Wehmeyer (Monog. p. 252) found a specimen in Plowright's Exs. to be mostly an effuse *Anthostoma*.

— **Vizeana** Sacc. & Speg.; *Syll.* I, 451; *Physalospora* Cooke in **14** (XVII, 88); Massee **14** (XVIII, 11); *Nectria caulina* Cooke in **14** (V, 62, 1876); Cooke Exs. II, No. 479; Vize Exs. 271; Plowr. Exs. III, No. 14. On *Buxus*.

Endothia radicalis (Schwein.) Ces. & de Not.; *E. fluens* Shear & N. E. Stevens in *U.S. Dept. Agric. Bull.* 380, 16, 1917. The first and apparently the only specimen collected in Britain was from the New Forest, and was described as *Sphaeria fluens* Sowerby in **42**, t. 438, 1815. Shear and Stevens found this specimen to be on *Castanea sativa*, but pycnidial only, hence the name "*fluens*" does not take priority in *Endothia*. Berkeley (**20**, 254, 1836) decided that Sowerby's fungus agreed with a specimen from Schweinitz of *Sphaeria gyrosa* Schw. Tulasne **114** (II, 87, 1863) records *Melogramma gyrosum* (Schw.) Tul. on *Carpinus* in France, and Cooke **15**, 802, 1871 used this name. Berkeley **18**, 384, 1860 and Massee **14** (XV, 38) used the name *Endothia gyrosa* (Schw.) Fuckel; but Shear and Stevens considered that *E. gyrosa* has not been found in Europe.

Glomerella cingulata (Stonem.) Spauld. & von Schrenk. Often recorded on *Pyrus Malus* or *Vitis*, usually in the conidial stage *Gloeosporium fructigenum* Berk. For literature see Wormald **31** (1930, 498*); **93**, 129; Grove **1**, 221.

— **phacidiomorpha** (Ces.) Petrak. Kinghorn **34** (XXIII, 30*, 1936); Grove **27** (1932, 3) and Rilston **27** (1935, 101) as *Physalospora Phormii* Schroet. On *Phormium*, Cornwall and Devon.

Gnomoniella Avellanae (Schmidt ex Fr.) Sacc. Berk. **19**, No. 101, 1838 as *Sphaeria*; Cooke **15**, 910; Berk. Exs. 182; Cooke Exs. 498; *Gnomonia* Cooke in **14** (XVII, 51); Massee **14** (XVII, 74). On dead leaves of *Corylus*.

Gnomoniella Coryli (Batsch ex Fr.) Sacc. Cooke **89**, 140, 1906; Cooke **14** (XVII, 51) as *Gnomonia*; Massee **14** (XVII, 74); Cooke Exs. 495 and II, No. 278; Greville **39**, t. 330, 1828 as *Sphaeria*; Berk. **20**, 257, 1836; Cooke **15**, 910. On leaves of *Corylus*.

— **devexa** (Desm.) Sacc. Phill. & Plowr. **14** (VI, 27, 1877) as *Plagiostoma*; **14** (VII, 87) as *Sphaeria*; Plowr. Exs. III, No. 85; Massee **14** (XVII, 74) as *Gnomonia*. On *Polygonum*, King's Lynn.

— **fimbriata** (Pers. ex Fr.) Sacc. Cooke **89**, 213*, 1906; Berk. **20**, 257, 1836 as *Sphaeria*; Cooke **15**, 909; **14** (VIII, 68); Berk. Exs. 36; Cooke Exs. 163 and II, No. 277; Plowr. Exs. II, No. 85; Vize Exs. 98; Massee **14** (XVII, 74) as *Gnomonia*. On *Carpinus*. This species and *G. Coryli* are often placed in *Mamiania*.

— **lugubris** (Karst.) Sacc. A. Lorrain Smith & Ramsbottom **28** (IV, 171, 1915) as *Gnomonia*. On *Potentilla*, Scotland.

— **Rosae** (Fuckel) Sacc. A. Lorrain Smith **28** (VI, 149, 1919) as *Gnomonia*. On *Rosa*, Scotland. See also Grove **1** (I, 171).

— **tubiformis** (Tode ex Fr.) Sacc. Hooker **92**, 7, 1821 as *Sphaeria* (on *Corylus*); Berk. **20**, 277; Greville **39**, t. 335, 1828; Currey **45** (XXII, 332*, 1859); Cooke **15**, 910; Plowr. Exs. II, No. 86; Massee **14** (XVII, 74) as *Gnomonia*; **7**, 232. On *Alnus*, etc.

— **vulgaris** (Ces. & de Not.) Sacc. Massee **14** (XVII, 74); Sowerby **42**, t. 373, 1802 as *Sphaeria gnomon* Tode; Purton **55** (III, No. 1521, 1820); Berk. **20**, 277; Greville **39**, t. 335, 1828; Cooke **15**, 911; Berk. Exs. 38; Cooke Exs. 598 and II, No. 279; Vize Exs. 189; Plowr. Exs. I, No. 93; Greville **51**, 360, 1824 as *Cryptosphaeria gnomon*. On *Corylus*.

Guignardia acerifera (Cooke) Lindau in Engler-Prantl, 1897; *Laestadia* Sacc. in *Syll.* I, 423; Massee **14** (XIX, 13); *Sphaerella* Cooke in **27** (IV, 248*, 1866); **15**, 916, "referred doubtfully by Auerswald to *Sphaerella sparsa*"; Cooke Exs. 687 and II, No. 271. On leaves of *Acer campestris*. See also *Laestadia* for other species of *Guignardia*.

— **Bidwellii** (Ellis) Viala & Ravaz. Massee **5B**, 105; Cooke **89**, 158*; Massee **31** (1895, 101*) as *Laestadia*, "undoubted evidence of its occurrence in Britain". On *Vitis*. See *Elsinoe ampelina*.

— **caricicola** (Fuckel) Lind (Feb. 1913); transferred also by Migula in 1913. Massee **14** (XIX, 43, 1890) as *Laestadia*. On *Carex*, N. Wootton.

— **carpinea** (Fr.) Schroet. Massee **14** (XIX, 13) as *Laestadia*; B. & Br. **19**, No. 655, 1852 as *Sphaeria*; Cooke **27** (IV, 248*, 1866) as *Sphaerella*; **15**, 916; Bucknall **46** (III, 20); Cooke Exs. 165 and II, No. 272; Plowr. Exs. II, No. 89; Vize Exs. 196. On *Carpinus*. Potebnia **102** (VIII, 54) made this the type of his genus *Sphaerognomonia*.

— **Cookeana** (Auersw.) Feltgen. O'Connor **70** (XXI, 397); Sacc. I, 421 as *Laestadia*; Massee **14** (XIX, 12); "*Sphaerella punctiformis*" in **15**, 914, 1871; *S. Cookeana* Auersw. in *Myc. Eur. Pyr.* 1869. On leaves.

— **echinophila** (Schwein.) Trav. Massee **37** (Add. Ser. V, 150, 1906) as *Laestadia*. On involucres of *Castanea*, Kew.

— **maculiformis** (Bonord.) Migula. Grove **27** (LXVIII, 70*, 1930). On *Fagus*, Worcs.

— **perpusilla** (Desm.) Trav. Massee **14** (XIX, 13) as *Laestadia*; Cooke **14** (V, 122, 1877) as *Sphaerella*; **14** (VII, 88); Cooke Exs. II, No. 572. On grasses.

— **pinastri** (DC. ex Fr.) Lindau. Greville **39**, t. 13, 1823 as *Sphaeria*; Berk. **20**, 270; Currey **45** (XXII, 324*); Cooke **27** (IV, 248*, 1866) as *Sphaerella*; **15**, 916. On needles of *Pinus*.

— **punctoidea** (Cooke) Schroet. *Sphaerella* Cooke in **27** (IV, 247*, 1866); **15**, 915; *Laestadia* Auersw. in **105** (1869, 178); Sacc. I, 420; Massee **14** (XIX, 12). On *Quercus*.

— **rhytismoides** (Babington ex Berk.) Trav. *Sphaeria* Bab. [nom. nud. in **36** (Proc. 1838–48, 32)] ex Berk. in **19**, No. 178*, 1841; Currey **45** (XXII, 286*); Berk. Exs. 324; Cooke **15**, 931 as *Isothea*; *Laestadia* Sacc. in *Syll.* I, 424; Massee **14** (XIX, 13); **70** (XXI, 398). On *Dryas*.

Laestadia faginea (Cooke & Plowr.) Sacc. in *Syll.* II, XXXI; Massee **14** (XIX, 13); *Sphaerella* Cooke & Plowr. in Plowr. Exs. III, No. 100; Cooke **27** (XXI, 68, 1883). On *Fagus*, King's Lynn. *Laestadia* is untenable as a generic name for fungi, but these four species have apparently not been transferred to *Guignardia*.
— **Iridis** (Cooke) Berl. & Vogl. in Sacc. *Addit. I–IV*, 61; Massee **14** (XIX, 13); *Sphaerella* Cooke in **14** (XIII, 99, 1885). On *Iris*, Kew.
— **Periclymeni** Pass. O'Connor **70** (XXI, 398, 1936). On *Lonicera*, Ireland.
— **rhodorae** (Cooke) Berl. & Vogl. in Sacc. *Addit. I–IV*, 62; Massee **14** (XIX, 13); *Sphaerella* Cooke in **14** (XIII, 99, 1885, "can scarcely be *Laestadia Rhododendri* Not."); Vize Exs. 599. On leaves of *Rhododendron*, Kew. Von Höhnel (*Mittel. Bot. Inst. Tech. Hochsch. Wien*, VIII, 35) transferred it to *Discochora*.
[**Lasiosphaeria**: see Phragmosporae.]
Ophiostoma coeruleum (Münch) Syd. M. Wilson **64** (XXXVI, 82, 1922) as *Ceratostomella*; **76** (XI, 42). On wood. *Ophiostoma* perhaps should be excluded from the Sphaeriales (see refs. in Chesters **113** (1938, 179)). See *Ceratostomella* above.
— **Piceae** (Münch) Syd. MacCallum **28** (VII, 231, 1922) as *Ceratostomella*, said to be common; M. Wilson **64** (XXXVI, 85, 1922). On *Picea* and *Pinus*.
— **piliferum** (Fr.) Syd. Berk. **20**, 266, 1836 as *Sphaeria*; Cooke **15**, 876; Massee **14** (XVII, 74) as *Ceratostoma*; A. Lorrain Smith & Ramsbottom **28** (VI, 366) as *Sphaeronema*; M. Wilson **64** (XXXVI, 82) as *Ceratostomella*, considered an early name for various blue-stain fungi. H. & P. Sydow **102** (1919, 43) designated this species as the type of the genus *Ophiostoma*. On *Pinus*.
— **Pini** (Münch) Syd. MacCallum **28** (VII, 231, 1922) as *Ceratostomella*; M. Wilson **28** (XIII, 84); **64** (XXXVI, 85); **71** (XL, 49); **112**, 177. On *Pinus*.
— **pluriannulatum** (Hedgc.) Syd. Mary Gregor **102** (XXI, 1*, 1932) as *Ceratostomella*. On *Ulmus*.
— **Ulmi** (Buisman) Nannf. Walter **99**, 551 as *Ceratostomella*; Ainsworth **93**, 226, with references. The first record of elm disease caused by this fungus in Britain is Wilson **31** (LXXXIII, 31*, 1928) as *Graphium Ulmi*.
Phomatospora argentina Speg. Rea & Hawley **71** (XXXI, Part 13, p. 7*, 1912). On *Beta maritima*, Clare Island.
— **Berkeleyi** Sacc. gen.nov. in *Fungi Ven.* Ser. II, 306, 1875; *Syll.* I, 432; Massee **14** (XVIII, 40); *Sphaeria phomatospora* B. & Br. in **19**, No. 647*, 1852; Currey **45** (XXII, 325); Cooke **15**, 884. On stalks of *Solanum tuberosum*.
— **endopteris** (Plowr.) Phill. & Plowr. in **14** (XIII, 76, 1885); Sacc. *Addit. I–IV*, 63; **14** (XVIII, 40); *Sphaeria* Plowr. apud Bucknall in **46** (III, 269, 1882). On *Pteridium*, Bristol.
— **ribesia** (Cooke & Massee) Sacc. in *Syll.* IX, 591; *Sphaeria* Cooke & Massee in **14** (XV, 110, 1887). On twigs of *Ribes*, Battle Abbey. Petrak & Sydow **102** (XXII, 370) found nothing corresponding to the diagnosis on the type specimen.
— **Sphaerulina** Grove in **27** (LX, 172, 1922). On *Asclepias*, Birmingham.
— **therophila** (Desm.) Sacc. Grove **27** (LXVIII, 68, 1930). On *Juncus*, Wales.
Physalospora Corni Sacc. Massee **14** (XVIII, 10, 1889); *Sphaeria corniella* Cooke in **14** (VIII, 10, 1879). On *Cornus*, Shrewsbury.
— **Euphorbiae** (Phill. & Plowr.) Sacc. in *Syll.* I, 436; *Phomatospora* Cooke in **14** (XVIII, 13 and 40); *Sphaerella* Phill. & Plowr. in **14** (VI, 28, 1877); **14** (VII, 88); Plowr. Exs. III, No. 97. On *Euphorbia*.
— **Festucae** (Lib.) Sacc. Grove **27** (LXVIII, 68*, 1900). On *Aira* and *Brachypodium*, Worcs.
— **gregaria** Sacc. var. **foliorum** Sacc. Callen **28** (XXII, 100*, 1938). On *Taxus*, Scotland.
— **Ilicis** (Schleich.) Sacc. Massee **14** (XIX, 13, 1890) as *Laestadia*. On *Ilex*, Apethorpe.
— **Lonicerae** Grove in **27** (LXVIII, 67, 1930). On *Lonicera*, Worcs.
— **Miyabeana** Fukushi. Nattrass **28** (XIII, 294*, 1928); **23** (XXXVI, 363, 1929); **104** (VII, 239, 1929); **32** (XXXIV, 64); **79** (VIII, 25; XI, 59); **28** (XVI, 76); **85** (XLI, 18); **93**, 224; **112**, 183*; **71** (XLII, 50, 1934, *Gloeosporium* st. ge); for years this fungus in Britain was called *P. gregaria* Sacc., following Johnson **70** (X,

153*, 1904); **25** (1904, 543); **23** (XXI, 290); **64** (XXXVIII, 130); **23** (XXIV, 845 and XXIX, 1056) as *Botryosphaeria gregaria*; **5**, 175. On *Salix*.

Physalospora mutila N. E. Stevens in **100** (XXVIII, 333, 1936). Type on *Fraxinus excelsior*, Cornwall; also on *Pyrus Malus*. The pycnidial stage is *Diplodia mutila* Fr. (=*Sphaeropsis Malorum* (Berk.) Berk.).

— **obtusa** (Schwein.) Cooke in **14** (XX, 86); N. E. Stevens **100** (XXVIII, 330, 1936; **93**, 129; **112**, 184) as *P. Cydoniae*. On *Pyrus Malus* and *Crataegus* in England. The pycnidial stage is *Sphaeropsis Malorum* Peck.

— **psoromoides** (Borr.) Wint. Wint. **105** (1886, 23); A. Lorrain Smith **28** (III, 177); Massee **14** (XVIII, 40). On lichens. Keissler **119**, 346 transfers to *Guignardia* and gives extensive synonymy.

— **rosicola** (Fuckel) Sacc. Massee **14** (XVIII, 10); Grove **27** (LXVIII, 68, 1930); Cooke **14** (XIII, 99, 1885) as *Sphaeria*. On *Rosa*, Kew and Worcs. Cooke's specimen is *Didymella* (*Apiospora*) *sepincoliformis* (q.v.).

— **Thistletonia** Cooke in **14** (XVIII, 74, 1890); Sacc. IX, 597. On *Rhododendron*.

Trichosphaeria barbula (Berk. & Br.) Wint. in Rabenhorst's *Krypt. Fl.* II, 206; **108** (1930, 109); *Sphaeria* B. & Br. in **19**, No. 870*, 1859; *Venturia* Cooke in **15**, 924; Sacc. I, 591; Massee **14** (XVI, 38). On bark of *Pinus*. This may be an *Eriosphaeria*, for the spores were described as 2-celled.

— **caesia** (Carmichael ex Currey) Sacc. in *Syll.* I, 453; *Sphaeria* Carm. ex Currey in **45** (XXII, 316*, 1859); Cooke **15**, 857; *Lasiosphaeria* Cooke in **14** (XV, 124); Massee **14** (XVI, 36). On rotted wood, Appin.

— **crassipila** Grove in **27** (L, 48, 1912). On wood, Studley Castle.

— **myriocarpa** (Fr.) Petrak & Syd. in **102** (XXII, 331); Greville **39**, t. 152, 1825 as *Sphaeria* (accepted by Fries in *Elenchus* II, 94); Berk. **20**, 266; Cooke **15**, 868; Cooke Exs. 373; Plowr. Exs. I, No. 76; *Psilosphaeria* Stevenson in **13**, 387; *Rosellinia* Cooke in **14** (XVI, 52); Massee **14** (XVI, 118); **7**, 229; *Sphaeria ostioloidea* Cooke in **14** (IV, 113, 1876); Bucknall **46** (II, 217); *Psilosphaeria ostioloidea* Cooke in **14** (VII, 84); **14** (XVI, 117); *Zignoella ostioloidea* (Cooke) Sacc. in *Syll.* II, 220; Crossland **7A**, 276 as *Wallrothiella minima*; Grove **27** (L, 48); *Psilosphaeria minima* (Fuckel) Cooke in **14** (XVI, 50); **7**, 228. On wood and old fungi. See *Melanomma Stevensonii*.

— **pilosa** (Pers. ex Fr.) Fuckel. Berk. **20**, 262, 1836 as *Sphaeria*; Currey **45** (XXII, 316*, 1859); B. & Br. **19**, No. 1096, 1865; Cooke **15**, 860; *Lasiosphaeria* Cooke in **14** (XV, 124); Massee **14** (XVI, 36). On coniferous wood.

— **superficialis** (Currey) Sacc. in *Syll.* I, 452; Boyd **28** (IV, 69); *Sphaeria* Currey in **45** (XXII, 317*, 1859); Cooke **15**, 858; *Lasiosphaeria* Cooke in **14** (XV, 124); Massee **14** (XVI, 36). On wood of *Pinus*.

Tympanopsis euomphala (Berk. & Curt.) Starb. On *Fraxinus*, associated with *Hypoxylon rubiginosum*. First known British collection Mickleham, Surrey, in 1930. See Chesters **28** (XXIII, 235) and Fitzpatrick **100** (XV, 54).

SPHAERIACEAE: PHAEOSPORAE

The Phaeosporous Sphaeriaceae include such diverse groups as the Chaetomiaceae and the Xylariaceae, placed at the beginning and the end of Winter's classification of Sphaeriaceae. The coprophilous genera cited here as *Coprolepa*, *Hypocopra*, *Philocopra* and *Sordaria*, as Saccardo grouped them, have been variously transferred subsequently, e.g. by Traverso in *Flora Italica*, by Cain (*Univ. Toronto Studies*, Biol. Ser. 38, 1934), and in the U.S.A. by Griffiths (*Mem. Torrey Bot. Club*, XI, No. 1, 1901). Chivers's monograph of *Chaetomium* and *Ascotricha* (*Mem. Torrey Bot. Club*, XIV, 155–240, 12 pls. 1915) has been consulted for those two genera. J. H. Miller has reclassified most of the British species of the Xylariaceae.

Anthostoma amoenum (Nits.) Sacc. Hawley **28** (VIII, 228, 1923). On *Quercus*, Cumberland.

— **cubiculare** (Fr.) Nits. Phill. & Plowr. **14** (VI, 25, 1877). On wood, Norfolk.

Anthostoma decipiens (DC. ex Fr.) Nits. Berk. **20**, 246, 1836 as *Sphaeria*; Currey **45** (XXII, 284*, 1858); Cooke **15**, 800; Rabenh. *Fungi Eur.* II, No. 144, 1860, coll. Broome; *Eutypa* Tul. in **114** (II, 59); *Botryosphaeria* Cooke in **14** (XIII, 108). On *Carpinus*.

— **denigrans** (Currey) Sacc. in *Syll.* I, 308; *Sphaeria* Currey in **45** (XXII, 270*, 1858); *Diatrype* B. & Br. in **19**, No. 835, 1859; Cooke **15**, 816; **14** (XV, 69). On dead branches.

— **dryophilum** (Currey) Sacc. in *Syll.* I, 308; **37** (1936, 65): *Sphaeria* Currey in **45** (XXII, 269*, 1858); *Diatrype* B. & Br. in **19**, No. 832, 1859; Cooke **15**, 816; **7**, 222; **14** (XV, 69). On *Quercus*. Tulasne **114** (II, 89, 1863) placed this with *A. gastrinum*.

— **gastrinoides** (Phill. & Plowr.) Sacc. in *Syll.* I, 763; *Valsa* Phill. & Plowr. in **14** (X, 71, 1881); Bucknall **46** (III, 268*, 1882). On *Viburnum*, Bristol.

— **gastrinum** (Fr.) Sacc. Berk. **18**, 386, 1860, as *Hypoxylon*; *Melogramma* Tul. in **114** (II, 88, 1863); Cooke **15**, 803; Plowr. Exs. I, No. 24; *Fuckelia* Cooke in **14** (XIII, 108); **14** (XV, 38); ?*Sphaeria irregularis* Sowerby in **42**, t. 374, 1802; B. & Br. **19**, No. 598, 1851; Currey **45** (XXII, 273*). On *Ulmus*.

— **italicum** Sacc. & Speg. Bucknall **46** (V, 52); **14** (XIII, 76); Bucknall **46** (IV, 60*, 1883) as *Sphaeria*. On *Eupatorium*, Bristol.

— **melanotes** (Berk. & Br.) Sacc, in *Mich.* I, 326; *Syll.* I, 294; *Sphaeria* B. & Br. in **19**, No. 623*, 1852; Cooke **15**, 878; Cooke Exs. 588 and II, No. 492; Plowr. Exs. I, No. 79 (altered in Cent. III to *A. Schmidtii* Nits., a synonym); *Xylosphaeria* Stevenson in **13**, 398, 1879; Massee **14** (XVIII, 8); Bucknall **46** (III, 69). On wood, especially *Ulmus*.

— **Plowrightii** (Niessl) Saçc. in *Syll.* I, 305; O'Connor **70** (XXI, 379); *Fuckelia* Niessl in **105** (1875, 130; Type collection Plowr. Exs. II, No. 18 issued as *Dothidea tetraspora* B. & Br.); Cooke Exs. 490; **14** (VI, 25; VII, 79; XV, 38); Bucknall **46** (V, 132, 1887) as *Sphaeria Plowrightii* [n.comb.?]. On *Ulex*.

— **saprophilum** Ellis & Everh. Rea and Hawley **71** (XXXI, Part 13, p. 16, 1912). On *Acer*, Clare Island.

— **turgidum** (Pers. ex Fr.) Nits. **37** (1936, 65); Berk. **20**, 250, 1836 as *Sphaeria*; Currey **45** (XXII, 278*); Cooke **15**, 836 as *Valsa*; **7**A, 277; *Diatrype* Cooke in **14** (XIV, 16); Massee **14** (XV, 69); **7**, 223 as *Valsa pustulata*. Common on *Fagus*.

— **xylostei** (Pers. ex Fr.) Sacc. Berk. **20**, 270, 1836 as *Sphaeria*; Currey **45** (XXII, 324*, 1859); Cooke **15**, 881; **13**, 399; Plowr. Exs. II, No. 63; *Xylosphaeria* Cooke in **14** (XVII, 86); Massee **14** (XVIII, 8). On *Lonicera*.

Anthostomella Ammophilae [as "*ammophila*"] (Phill. & Plowr.) Sacc. in *Syll.* I, 763; Grove **27** (1922, 168); Rilstone **27** (1935, 102); *Sphaeria* Phill. & Plowr. in **14** (X, 73*, 1881). On *Ammophila*. Von Höhnel (*Frag. Myk.* No. 1205, 1920) has transferred this and other names to *Entosordaria*.

— **appendiculosa** (Berk. & Br.) Sacc. in *Mich.* II, 234 and *Syll.* I, 286; *Sphaeria* B. & Br. in **19**, No. 613*, 1851; Currey **45** (XXII, 326*, 1859); Cooke **15**, 892; Bucknall **46** (III, 69); **14** (XVIII, 11) as *Anthostoma*. On *Rubus*. See R. Maire, *Bull. Soc. Hist. Nat. Afr. Nord.* VIII, 166.

— **clypeata** (de Not.) Sacc. J. W. Ellis, *Fungus Flora Wirral*, p. 62; Massee **14** (XVIII, 11) as *Anthostoma*. On *Rubus*. See Rhodes **108** (1933, 53).

— **lugubris** (Rob. in Desm.) Sacc. Grove **27** (LXVIII, 67*, 1930); Rilstone **27** 1935, 102). On *Ammophila*.

— **Myricae** Grove in **27** (LXXI, 252*, 1933). On *Myrica*, Wales.

— **phaeosticta** (Berk.) Sacc. in *Mich.* I, 374 and *Syll.* I, 279; Massee **14** (XVIII, 57, (1890); B. & Br. **19**, No. 651*, 1852 as *Sphaeria*; Currey **45** (XXII, 330*, 1859); Cooke **15**, 899; Bucknall **46** (IV, 60); *Leptosphaeria* Auersw. in *Myc. Eur.* t. 11. On *Carex*.

— **pullulans** Bennett in **34** (XV, 371*, 1928) as the perfect stage of *Dematium pullulans* de Bary; **93**, 23. On straw of *Triticum*. This species belongs to the Hyalosporae.

Anthostomella punctulata (Rob. & Desm.) Sacc. Grove **27** (LXVIII, 66*, 1930). On *Luzula*, Ribblesford Wood.

— **Taxi** Grove in **27** (LXXI, 253*, 1933); Rhodes **108** (1933, 48); discussed by Callen **28** (XXII, 102*, 1938). On *Taxus*, Worcs. and Scotland.

— **tomicoides** Sacc. A Lorrain Smith and Ramsbottom **28** (V, 239, 1916); Rilstone **27** (1935, 102). On *Eupatorium* and *Rubus*.

— **tomicum** (Lév.) Sacc. Massee **14** (XVIII, 57, 1890); Currey **45** (XXII, 324*, 1859) as *Sphaeria*; Cooke **15**, 894; var. *minor* in B. & Br. **19**, No. 633*, 1852. On *Aira* and *Juncus*.

Ascotricha chartarum Berk. gen.nov. in **19**, No. 116, 1838; Sacc. I, 37; Cooke **52**, 221*, 1865; **15**, 654*; Vize Exs. 348, 355, 474; Chivers Monog. p. 222; *Chaetomium Berkeleyi* Schroet. in *Krypt Fl. Schles.* 3, 284, 1894. On paper.

Bombardia fasciculata Fr. *Rosellinia* Cooke in **14** (XVI, 52); Massee **14** (XVI, 118); Berk. **20**, 264, 1836 as *Sphaeria bombarda* Batsch; Currey **45** (XXII, 317*, 1859); Cooke **15**, 860; Berk. Exs. 268; Vize Exs. 500; Plowr. Exs. III, No. 48; *Sphaeria reptans* Sowerby in **42**, t. 395, 1803. On wood. Chenantais **117** (XXXV, 78, 1919) transferred it as *Lasiosordaria Bombardia*.

[**Bovilla Capronii** Sacc. gen.nov. in *Syll.* II, 360; *Sphaeria bovilla* Cooke in **15**, 874*, 1871; *Sordaria bovilla* Cooke in **14** (XVI, 55); Massee **14** (XVI, 119). On dung, Shere. Massee and Salmon **33** (XV, 343, 1901) and Grove **27** (1930, 66) point out that the fungus was immature *Sordaria coprophila*, q.v.].

Camarops polyspermum (Mont.) J. H. Miller in **28** (XV, 151*, 1930); Shear **100** (XXX, 585). On *Alnus*, E. W. Mason Herb. No. 105.

Ceratostoma Masoni Kirschst. in **28** (XVIII, 306*, 1934). On *Quercus*, E. W. Mason Herb. No. 882, Richmond Park, Surrey.—The present use of *Ceratostoma* appears invalid, unless conserved. See Mason, *Annotated Account*, List II, Fasc. 2, 1933.

— **Notarisii** Sacc. Massee **37** (1912, 165*). On damp paper and cotton, Kew.

Chaetomium arachnoides Massee & Salm. in **33** (XVI, 71*, 1902). Described on dung from Gold Coast, Africa, but Massee **37** (1912, 163) records it on damp paper, Kew. Chivers (p. 217) examined specimens sent from Kew Herb. and decided that they did not belong to *Chaetomium*.

— **atrum** Link. Massee **14** (XVI, 39, 1887). On *Heracleum*. A doubtful record. Chivers, p. 180, makes *C. atrum* a synonym of *C. elatum*.

— **bostrychodes** Zopf. Massee & Salmon **33** (XVI, 72*, 1902); **73** (2, VIII, 355); **33** (XLVII, 735, saltation); **37** (1912, 162*); **70** (XIX, 545); Chivers, p. 201. On dung, etc.

— **caprinum** Bainier. Dickson **33** (XLVII, 735, 1933, presumably a British record); Chivers p. 203.

— **chartarum** Ehrenb. ex Fr. Berk. **20**, 328, 1836; Cooke **52**, 221*, 1865; **15**, 653*; **7**, 228; Vize Exs. 475; Cooke Exs. 328. On paper. Chivers, p. 190, considers *C. chartarum* a synonym of *C. globosum*.

— **chlorinum** (Sacc.) Grove in **27** (L, 46, 1912, for *C. Fieberi* var. *chlorinum* Sacc. which Chivers, p. 190, regards as a synonym of *C. globosum*); **108** (1930, 109). On *Helianthus*, etc.

— **chlorinum** var. **rufipilum** Grove in **27** (I, 46, 1912); *C. Fieberi* var. *rufipilum* (Grove) Sacc. in *Syll.* XXIV, 839; **33** (XLVII, 735, 1933). On stems, etc.

— **cochliodes** Palliser. Dickson **33** (XLIV, 389, 1932; XLVII, 735; L, 334 and 702); Chivers, p. 204. On old stems.

— **crispatum** Fuckel. A. Lorrain Smith & Rea **28** (II, 36, 1903); **37** (1912, 163*); **34** (XVII, 293); Chivers, p. 171. On bulbs, paper, and in soil.

— **elatum** Kunze & Schmidt ex Fr. Greville **39**, t. 230, 1826; Berk. **20**, 328, 1836; Cooke **52**, t. XII, 1865; **15**, 652; **28** (I, 185); **33** (XV, 334; XLVII, 735); **68** (1901, 614); Tul. **114** (II, 267); Chivers p. 180; Berk. Exs. 49; Cooke Exs. 100 and II, No. 290; Vize *Fungi Brit.* No 100; *Sphaeria scopula* Sowerby in **42**, t. 386, 1803; B. & Br. **19**, No. 636*, 1852 as *S. comata* Tode; **14** (XVI, 39) as *Chaetomium comatum*; **37** (1912, 164*). On straw, seeds, etc.

Chaetomium funicola Cooke in **14** (I, 176, 1873); Sacc. I, 226; **14** (XVI, 39); Chivers, p. 176. On twine, British Museum.

— **glabrum** Berk. & Br. in **19**, No. 1397*, 1873; nom. nud. in **18**, 405, 1860 and Cooke **15**, 653. Sacc. I, 35 and Chivers, p. 214 placed it with *Anixia perichaenioides*, q.v. On damp straw.

— **globosum** Kunze ex Fr. Dickson **33** (XLVII, 736*, 1933, saltation); see *C. chartarum*. On old paper, etc. Following Chivers, *C. globosum* is the valid name for the commonest British *Chaetomium*.

— **griseum** Cooke in **14** (I, 175, 1873); Sacc. I, 226; Massee **14** (XVI, 39); **37** (1912, 165). On old sacking, etc. Chivers, p. 167, examined the type specimen and found it to be *C. murorum*.

— **indicum** Corda. Cooke **15**, 657, 1871 and Exs. 216; Massee **14** (XVI, 39) and **37** (1912, 165). Both Cooke and Massee say that the fungus appeared on paper from India and that it is not known from Britain, but Chivers, p. 178, treats it as having a distribution including Europe.

— **Kunzeanum** Zopf. A. Lorrain Smith **68** (1901, 614); **28** (I, 183); **37** (1912, 164*). On farm seeds and damp paper. Teste Chivers, p. 190, a synonym of *C. globosum*.

— **lageniforme** Corda. Massee **37** (1907, 240*). On a twig, Kew. Teste Chivers, p. 181, a synonym of *C. elatum*.

— **murorum** Corda. Cooke **52** (Ed. II, 226); **15**, 653, 1871; Massee **14** (XVI, 39); **33** (XV, 334; XVI, 71); **37** (1912, 163); **74** (VII, 59); **33** (XLVII, 735*); Chivers p. 166. On plaster, cloth, etc. See *Bolacotricha grisea* above.

— **pannosum** Wallr. Massee **37** (1912, 165); **28** (VI, 47, 1918); **32** (XXXIII, 372). On old plants. Chivers, p. 181, considers the name a synonym of *C. elatum*.

— **rufulum** Berk. & Br. in **19**, No. 1397*, 1873; Sacc. I, 228; Cooke **14** (II, 165*). On paper. Chivers, p. 214, considers that the description and figures indicate that this is not a *Chaetomium*.

— **simile** Massee & Salm. in **33** (XVI, 71*, 1902); Sacc. XVII, 601; **37** (1912, 164); Chivers p. 169. On dung, Kew.

— **spirale** Zopf. Bayliss Elliott **34** (XVII, 290, 1930); Chivers p. 199. From soil of a salt marsh.

Coprolepa equorum Fuckel. Phill. & Plowr. **14** (IV, 124*, 1876) as *Sphaeria*; Cooke Exs. II, Nos. 241, 242; Plowr. Exs. II, No. 57; **14** (VII, 85 and XVI, 120) as *Sordaria*; **40** (VII, 115). On dung.

— **fimeti** (Pers. ex Fr.) Sacc. Berk. **20**, 246, 1836 as *Sphaeria*; Cooke **15**, 847 as *Massaria*; Massee **14** (XVI, 120) as *Sordaria*. On dung, Appin.

— **merdaria** (Fr.) Fuckel. Phill. & Plowr. **14** (IV, 123, 1876) as *Sphaeria*; Plowr. Exs. II, No. 56; **14** (VII, 85) as *Sordaria*; **13**, 393; **14** (XVI, 120); Bucknall **46** (III, 138); Plowr. Exs. III, No. 44. On dung.

Daldinia concentrica (Bolton ex Fr.) Ces. & de Not. gen.nov. in *Schema* I, 197; Sacc. I, 393; Massee **14** (XV, 34, 1886); **34** (XVI, 400); Brooks **28** (IV, 245, cultures); Bayliss Elliott **28** (VI, 269*); **89**, 211; Miller **28** (XV, 152*, 1930); *Sphaeria* Bolton in **111**, t. 180, 1791; **92**, 4, 1821; **20**, 236; *Hypoxylon* Greville in **39**, t. 324, 1828; Berk. **18**, 386; **31** (1861, 72*); **45** (XXV, t. 45); **15**, 794; Tul. **114** (II, 31); Plowr. Exs. I, No. 17; *Stromatosphaeria* Greville in **51**, 355, 1824; *Sphaeria fraxinea* Withering in **38**, 2nd Ed.; Sowerby **42**, t. 160, 1798; *Fungus fraxineus* [etc.] Ray, 1686. Common on deciduous trees. See Marion Child **101** (XIX) for *Daldinia*.

[— **vernicosa** (Schwein.) Ces. & de Not. Recorded **28** (XIII, 310) on *Betula*, 1927 Foray at Aviemore. The specimens were considered by Miller to be *D. concentrica*.]

Endoxyla operculata (Alb. & Schw. ex Fr.) Fuckel. Massee **14** (XVIII, 8, 1889). On *Pinus*, Scotland. Von Höhnel (**102**, XVI, 135) placed *Endoxyla* in the Phaeosporae (he considered it a section of *Anthostoma*); it has often been included in the Allantosporae.

— **parallela** (Fr.) Fuckel. Massee **14** (XVIII, 8, 1889); Cooke **14** (I, 174, 1873) as *Sphaeria*; *Xylosphaeria* Cooke in **14** (VII, 86); **13**, 399. On *Pinus*, Scotland.

Gelasinospora tetrasperma Dowding. Eleanor S. Dowding (*Canadian J. Res.* IX, 295, 1933) found "*Sordaria fimicola*, four-spored form" **28** (XVII, 296*, 1933) to be her *G. tetrasperma*. From soil, Oxshott, Surrey.

Helminthosphaeria Clavariarum (Tul.) Fuckel. Kirschstein **28** (XVIII, 305, 1934); Massee **14** (XVI, 36, 1887) as *Chaetosphaeria*; B. & Br. **19**, No. 563, 1851 as *Peziza*; Cooke **15**, 691; *Pleospora* Tul. in **114** (II, 271, 1863); *Peziza nigra* Sowerby in **42** t. 307, 1801. On *Clavaria*. Fuckel wrote the specific epithet "*Clavariae*". Kirschstein (loc. cit.) has transferred several species of *Rosellinia* section *Coniochaeta* to *Helminthosphaeria*.

Hypocopra capillifera (Currey) Sacc. in *Syll.* I, 246; *Sphaeria* Currey in **45** (XXII, 317*, 1859); Cooke **15**, 857; Bucknall **46** (II, 349); *Lasiosphaeria* Stevenson in **13**, 390; *Coniochaeta* Cooke in **14** (XVI, 17, 1887); Massee **14** (XVI, 37). On old wood, etc.

— **discospora** (Auersw.) Fuckel. Phill. & Plowr. **14** (II, 187, 1874) as *Sphaeria*; Vize Exs. 290; **14** (VII, 85) as *Sordaria*; **13**, 393; **14** (XVI, 120). On dung. Cain places this and several other species in *Coniochaeta*.

— **fimicola** (Rob. in Desm.) Sacc. B. & Br. **19**, No. 1097, 1865 as *Sphaeria*; Cooke **15**, 867, with *S. stercoraria* var. Currey **45** (XXII, 318*, 1859), cited as a synonym; Phill. & Plowr. **14** (VI, 28, 1877) as *Sordaria*; Bucknall **46** (III, 268, 1882); **14** (XVI, 119); **33** (XV, 342; XVI, 74; L, 334, 702 and 706); **74** (VII, 152); **32** (XXXIII, 372); Cooke Exs. II, No. 566. On dung, etc. See also *Gelasinospora* above.

— **fimicola** var. **canina** Karst. A Lorrain Smith **28** (III, 115, 1909). On dung.

— **humana** Fuckel. Stevenson **13**, 392, 1879 as *Sordaria*. On dung, Scotland.

— **maxima** (Niessl) Sacc. Phill. & Plowr. **14** (VIII, 107, 1880) as *Sordaria*. On dung.

— **microspora** (Phill. & Plowr.) Sacc. in *Syll.* I, 241; *Sordaria* Phill. & Plowr. in **14** (VI, 28*, 1877); **13**, 393; **46** (III, 269); **14** (XVI, 120); **7**, 231. On dung.

— **platyspora** (Phill. & Plowr.) Sacc. in *Syll.* I, 241; *Sordaria* Phill. & Plowr. in **14** (VI, 28*, 1877); Stevenson **13**, 394; **14** (XVI, 120); **46** (III, 69); **33** (XV, 342). On dung. Hawley **28** (VIII, 226) and Cain place this as a synonym of *H. scatigena*.

— **rotula** (Cooke) Sacc. in *Syll.* I, 246; *Sphaeria* Cooke in **15**, 868; Cooke Exs. 268; *Rosellinia* Cooke in **14** (XVI, 51); Massee **14** (XVI, 118). On sawdust, etc.

— **scatigena** (Berk. & Br.) Sacc. in *Syll.* I, 243; *Sphaeria* B. & Br. in **19**, No. 972*, 1861; Cooke **15**, 857; *Sordaria* Cooke in **14** (XVI, 55); Massee **14** (XVI, 120); A. Lorrain Smith **27** (XXXIV, 359); Foray 1920 as *S. discospora* var. *major*. On dung. See *H. platyspora* above.

— **serignanensis** Fabre. Crossland **35** (1900, 8): **7**, 231 as *Sordaria*. On dung, Yorks.

— **stercoraria** (Sowerby ex Fr.) Sacc. in *Syll.* I, 244; **33** (XV, 343, 1901); *Sphaeria* Sowerby in **42**, t. 357, 1802; Berk. **20**, 264, 1836; Currey **45** (XXII, 318*, 1859); B. & Br. **19** No. 1097, 1865; Cooke **15**, 867; *Sordaria* Cooke in **14** (XVI, 55); Massee **14** (XVI, 120); **33** (XV, 343); **27** (XXXIV, 359). On dung.

— **vesticola** (Berk. & Br.) Sacc. in *Syll.* I, 246; *Sphaeria* B. & Br. in **19**, No. 874, 1859; Cooke **15**, 869; *Sordaria* Cooke in **14** (XVI, 55); Massee **14** (XVI, 120); A. Lorrain Smith **27** (XXXIV, 359). On cotton cloth, Batheaston.

Hypoxylon Fr. British specimens have been described by J. H. Miller in three papers (cited "Miller I, II, or III" under the specific names) in **28** (XV, 134–54, 2 pls., 1930; XVII, 125–35, 3 pls., 1 fig., 1932; XVII, 136 46, 1932). See also Petch **35** (1938, 115).

— **argillaceum** Auct. Berk. **18**, 387, 1860; Cooke **15**, 795; Massee **14** (XV, 35); Miller I, 148; Rabenh. *Fungi Eur.* No. 247, coll. Broome; Plowr. Exs. I, No. 19; ?Berk. **19**, No. 169, 1841 as *Sphaeria*; Currey **45** (XXII, 266*, 1858). On *Fraxinus*. Miller, I and III, discusses the confusion over the name. See also *H. multiforme*.

[— **atropurpureum** Fr. Cooke **15**, 796, 1871; ?Bucknall **46** (II, 349); Massee **14** (XV, 35); **7**, 218; Berk. **20**, 239, 1836 as *Sphaeria*; Currey **45** (XXII, 267*). On wood. The British specimens are *H. rubiginosum*: see Miller III, 140.]

[**Hypoxylon botrys** Nits. Recorded by Berk. **20**, 239, 1836 and Cooke **15**, 862, as *Sphaeria botryosa* Fr. Currey **45** (XXII, 267*) examined a Friesian specimen. Miller III, 141, considers this name a synonym of *H. rubiginosum*, q.v.]

— "**coccineum** Bull." Cooke **15**, 794, 1871; **14** (XV, 34); Tul. **114** (II, 33, 1863); Berk. **18**, 386; Ingold **32** (XXXII, 184); **62** (XII, 83); Miller I, 146* and III, 136; Plowr. Exs. II, No. 10; Vize Exs. 275; Sowerby **42**, t. 271, 1800 as *Lycoperdon variolosum*; *Sphaeria tuberculosa* Sowerby in **42**, t. 374; Hooker **92**, 4, 1821 as *S. fragiformis*; Berk. **20**, 236; Currey **45** (XXII, 265*) and **66** (CXLVII, 548*); *Stromatosphaeria fragiformis* Greville in **39**, t. 136, 1825; Cooke Exs. 374 issued as *H. multiforme* var., then cited as type of *H. majusculum* Cooke, q.v. On *Fagus*. Miller III, 137 states that the correct name is *H. fragiforme* (Pers. ex Fr.) Kickx.

— **cohaerens** (Pers. ex Fr.) Fr. Berk. **18**, 387, 1860; Cooke **15**, 795; Massee **14** (XV, 35); Bucknall **46** (V, 50); Miller I, 138*; Plowr. Exs. III, No. 17 (not found recorded by Miller); Berk. **20**, 237, 1836 as *Sphaeria*; Currey **45** (XXII, 266*). On *Fagus*.

[— **confluens** (Tode ex Fr.) Cooke in **14** (XI, 139); Cooke **14** (XIII, 16) makes it a synonym of *H. semi-immersum*; B. & Br. **19**, No. 597, 1851 as *Sphaeria*; **18**, 395; Cooke **15**, 864. Reported on *Quercus*, *Salix*, etc. Same as *H. semi-immersum* below.]

[— **crustaceum** Nits. Cooke **14** (XI, 139, 1883). Miller I, 139 places *H. crustaceum* Nits. as a synonym of *H. multiforme*.]

— **decorticatum** Berk. in **14** (IV, 50, 1875). Teste Miller I, 145 this is *H. rubiginosum*, q.v.]

— **effusum** Nits. Massee & Crossland **7**, 369, 1905; **28** (II, 75, 1905). Yorks. Miller III, 143 finds the type of *H. effusum* to be *H. serpens*.

— **fuscum** (Pers. ex Fr.) Fr. Berk. **18**, 387, 1860; Tul. **114** (II, 38, 1863); Cooke **15**, 796; **14** (XV, 35); Miller I, 147*; Ingold **32** (XXXII, 190), spore discharge; Chesters **113** (1935, 100*); Vize Exs. 276; Plowr. Exs. I, No. 20; Cooke Exs. 246 and 467; Hooker **92**, 5, 1821 as *Sphaeria*; Berk. **20**, 237; Currey **45** (XXII, 266*); *Stromatosphaeria* Greville in **51**, 356, 1824; *Sphaeria tuberculosa* Bolton in **111**, t. 123, 1789; Sowerby **42**, t. 123, 1798. On *Corylus* and *Alnus* (teste Miller III, 148; reported on other hosts by some of the authors cited.

— **Howeianum** Peck. Miller II, 125*; Chesters **113** (1935, 103*, on Corylus); Plowr. Exs. II, No. 12, 1875 as *H. coccineum*. Teste Miller, records of *H. coccineum* on hosts other than *Fagus* belong here.

[— **majusculum** Cooke in **14** (VII, 80, 1879); Sacc. I, 361; based on Cooke Exs. 374 issued as *H. multiforme* var. This is *H. coccineum* (q.v.) teste Miller.]

[— **miniatum** Cooke: see *H. rutilum* below.]

— **multiforme** (Fr.) Fr. Berk. **18**, 386*, 1860; Tul. **114** (II, 41, 1863); Cooke **15**, 794; **14** (XV, 35); **35** (Sept. 1881); Miller I, 139*; Chesters **113** (1935, 98*); Thüm. Myc. Univ. No. 2174 ex Plowr.; Plowr. Exs. I, No. 18; Berk. **20**, 237, 1836 as *Sphaeria*; Currey **45** (XXII, 265*); Berk. Exs. 170; ?Berk. **19**, No. 169, 1841 as *S. argillacea*; perhaps *S. crustosa* Sowerby in **42**, t. 372, 1802 and t. 355 as *S. granulosa*, and *Stromatosphaeria elliptica* Greville in **39**, t. 114, 1824. On *Betula*.

[— **perforatum** Schwein. Cooke **14** (XVI, 77, 1888). On *Zea Mays*, Kew. Miller III, 140 regards this specimen as *H. rubiginosum*.]

— **rubiginosum** (Pers. ex Fr.) Fr. Berk. **18**, 387, 1860; Tul. **114** (II, 40, 1863); Cooke **15**, 796; **14** (XV, 35); Miller I, 144*; Vize Exs. Nos. 155 and 493; Plowr. Exs. I, No. 21; Thüm. Myc. Univ. No. 1071, coll. Plowright; Berk. **20**, 239, 1836 as *Sphaeria*; **19**, No. 16, 1837; Currey **45** (XXII, 267*); *Stromatosphaeria* Greville in **39**, t. 110, 1824 (but Tulasne, loc. cit., thinks this may have been *H. fuscum*); Cooke Exs. 666 as *H. cohaerens* and 668 as *H. multiforme* var. *effusum*, teste Miller III, 139; see *H. decorticatum* above. On most deciduous trees. Following a misdetermination by Berkeley, British specimens of *H. rubiginosum* on *Fraxinus* have usually been called *H. multiforme*.

Hypoxylon rutilum Tul. in **114** (II, 38, 1863); Miller I, 141*; *H. miniatum* Cooke in **14** (VII, 80, 1879); Sacc. I, 375; Massee **14** (XV, 35). Miller III, 141 found the type specimens of *H. rutilum* and *H. miniatum* to be identical. He notes that the species appears to be confined to *Fagus*.

— **semi-immersum** Nits. Massee **14** (XV, 35, 1886). Miller I, 143* and III, 144 uses this name for many British specimens including Plowr. Exs. II, No. 55 as *Sphaeria confluens*. He considers *H. confluens* (q.v.) to be the same species.

— **serpens** (Pers. ex Fr.) Fr. Cooke **15**, 797, 1871; Massee **14** (XV, 35); Miller I, 141* and III, 142; Chesters **113** (1935, 100*); Cooke Exs. 667; Vize Exs. 492; Plowr. Exs. II, No. 11; Berk. **20**, 239, 1836 as *Sphaeria*; Currey **45** (XXII, 267*); ?*S. crustacea* Sowerby in **42**, t. 372–3, 1802. On decaying wood of deciduous trees.

— **stygium** (Lév.) Sacc. Miller II, 130*, 1932, points out that the only specimens of this tropical species collected in Britain were from the Chatsworth conservatory, Glamis, and were probably on imported wood. They were referred in error to *H. marginatum* (Schwein.) Berk., another tropical species and teste Miller = *H. truncatum*, in **18**, 387, 1860; Cooke **15**, 795; Massee **14** (XV, 35); **7**, 218; B. & Br. **19**, No. 595, 1851 as Sphaeria; Currey **45** (XXVI, t. 46).

— "**udum** Fr." Cooke **15**, 797, 1871; Bucknall **46** (II, 217, 1878); Massee **14** (XV, 35); **7**, 218; Miller II, 126* and III, 144; Plowr. Exs. II, No. 12 (not found verified in Miller); Berk. **20**, 243, 1836 as *Sphaeria*; Currey **45** (XXII, 268*). On *Quercus*. See Miller II regarding the name.

Muellerella polyspora Hepp. A. Lorrain Smith **28** (III, 116, 1909, and p. 178, 1910). On a lichen, Jersey. See Keissler **119**, 315.

Neurospora sitophila Shear & Dodge. Ramsbottom & Frances Stephens **28** (XIX, 218*, 1935). From battens of *Fagus*, Chichester.

— **tetrasperma** Shear & Dodge. Ramsbottom & Frances Stephens **28** (XIX, 217*, 1935). Cultured from charred *Ulex* from Woolwich.

Nummularia Bulliardi Tul. in **114** (II, 43, 1863). Cooke **15**, 798*, 1871; Bucknall **46** (II, 217, 1878); **35** (June 1880, Sept. 1881); **7**, 217; ?Sowerby **42**, t. 373, 1802 as *Sphaeria diffusa*; Berk. **20**, 240, 1836 as *S. nummularia*; Currey **45** (XXII, 268*); Berk. **18**, 386, 1860 as *Hypoxylon nummularium* Bull.; Miller **28** (XVII, 128*, 1932). On *Fagus*, not common. See **28** (XXIII, 219) *re* the name *Nummularia*.

— **discreta** (Schwein.) Tul. Anon. **23** (XVIII, 314*, 1911); Crossland **35** (1912, 88); **112**, 207; Miller **28** (XVII, 132*, 1930). Only one British collection is known, on *Pyrus Malus* (crab-apple), Yorks.

— **gigas** Phill. & Plowr. in **14** (VIII, 106*, 1880); Sacc. I, 398; Cooke **14** (XII, 5). On *Betula*. Miller **28** (XVII, 134, 1932) saw no type, but Shear **100** (1938, 586) found a specimen apparently authentic and on this made var. *gigas* of *Camarops tubulina*.

— **lutea** (Alb. & Schw. ex Fr.) Nits. Massee **14** (XV, 34, 1886); Miller **28** (XVII, 146, 1932); Berk. **19**, No. 170, 1841 as *Sphaeria*; Currey **45** (XXII, t. 46); *Hypoxylon* Berk. in **18**, 386, 1860; Cooke **15**, 793; Miller **28** (XV, 149*); Plowr. Exs. I, No. 16. On *Buxus*, etc. Shear **100** (XXX, 585) transferred it to *Camarops* as *C. tubulina* (Alb. & Schw.) Shear.

[— **succenturiata** (Tode ex Fr.) Nits. Massee **14** (XV, 34, 1886); *Hypoxylon* Berk. & Br. in **19**, No. 830, 1859; Cooke **15**, 793. Recorded in error on *Quercus* and *Acer*.]

Ophiostomella rostellata (Grove) Petrak & Syd. in **102** (XXIII, 238, 1925); *Coniothryium* Grove in **27** (1886, 135); Sacc. *Addit. I–IV*, 135. On scales of *Pinus*.

Philocopra collapsa (Griff.) Sacc. & D. Sacc. Recorded **28** (XVI, 4); see Appendix I.

— **discospora** Plowr. in **28** (I, 62*, 1899); Sacc. XVI, 434. On dung, N. Wootton.

— **pleiospora** (Wint.) Sacc. Phill. & Plowr. **14** (X, 72, 1881) as *Sordaria*; Bucknall **46** (III, 138*, 1881); **33** (XV, 338); **7**, 370. On dung.

Philocopra polyspora (Phill. & Plowr.) Sacc. in *Syll.* I, 763; *Sordaria* Phill. & Plowr. in **14** (x, 73*, 1881); Bucknall **46** (III, 269*, 1882). On dung, Bristol.
— **pusilla** Mouton. Gibb **35** (1905, 139) as *Sordaria*; **7**, 370. On dung, Yorks.
— **setosa** (Wint.) Sacc. Massee & Salmon **33** (xv, 336*, 1901; xvi, 74) as *Sordaria*; **7**, 231. On dung.
Podospora Brassicae (Klotz.) Wint. in Rabenh. *Krypt.-Fl.* II, 171; *Sphaeria* Klotz. apud Berk. in **20**, 261, 1836; Currey **45** (XXII, 316*, 1859); B. & Br. **19**, No. 1333*, 1871; Cooke **15**, 856; Vize Exs. 288; Plowr. Exs. I, No. 64; *Lasiosphaeria* Stevenson in **13**, 389; *Coniochaeta* Cooke in **14** (XVI, 17, 1887); Massee **14** (XVI, 38); *Lasiosordaria* Chenan. in **117** (XXXV, 78); *Sordaria Curreyi* Auersw. in Niessl, *Beitr.* p. 192; Bucknall **46** (v, 52, 1886) as *Sordaria lanuginosa*. On old *Brassica*.
Poronia leporina Ellis & Everh. Crossland **35** (1901, 341, first record for Europe); Massee & Salmon **33** (XVI, 74*, 1902); **7**, 216. On dung, Yorks.
— **punctata** (Linn. ex Fr.) Fr. Berk. **20**, 235, 1836; **31** (1861, 193*); Cooke **15**, 791; **13**, 370; **33** (XIV, 245*); Plowr. Exs. II, No. 9; Cooke Exs. 468 and II, No. 213; Lightfoot **95** (II, 1050, 1777) as *Peziza*; Currey **45** (XXII, 265*) as *Sphaeria*; *Hypoxylon* Greville in **39**, t. 327, 1828; *Sphaeria truncata* Bolton in **111**, t. 127, 1789; Hooker **92**, 5, 1821 as *S. Poronia*. On dung.
Rosellinia Alchemillae A. L. Smith & Ramsb. in **28** (v, 239, 1916); Sacc. XXIV, 833. On *Alchemilla*, Scotland.
— **anthostomoides** Berl. Rea & Hawley **71** (XXXI, Part 13, p. 5*, 1912). On bark, Clare Island.
— **aquila** (Fr.) de Not. Tul. **114** (II, 249, 1863); **76** (IV, 5); **64** (XXXVI, 228*; XXXVII, 43); **5**, 234; **112**, 174; Kirschstein **28** (XVIII, 302*, 1934); Berk. **19**, No. 180, 1841 as *Sphaeria*; Currey **45** (XXII, 314*); Cooke **15**, 853*; Cooke Exs. 270 and II, No. 486; Vize Exs. 172; Plowr. Exs. I, No. 61; *Byssosphaeria* Stevenson in **13**, 385, 1879; Bucknall **46** (III, 69, 1880); Massee **14** (XVI, 35); Berk. **20**, 206, 1836 as *Sphaeria byssiseda*. Common on wood. See Kirschstein (loc. cit.) for notes on *Rosellinia*.
— **Buxi** Fabre. Kirschstein **28** (XVIII, 302*, 1934). On *Buxus*, Box Hill, Surrey.
— **callosa** Wint. Rhodes **108** (1933, 47); Petch **35** (1936, 58). On wood.
— **Desmazierii** (Berk. & Br.) Sacc. in *Fungi Ital.* t. 393 and *Syll.* I, 254; *Sphaeria* B. & Br. in **19**, No. 618*, 1852; Currey **45** (XXII, 314*); Cooke **15**, 854; *Byssosphaeria* Stevenson in **13**, 386, 1879; Massee **14** (XVI, 35, 1887). On wood.
— **detonsa** (Cooke) Sacc. in *Syll.* IX, 505; *Coniochaeta* Cooke in **14** (XV, 82, 1887). On wood of conifer, Jedburgh.
— **laminariana** Sutherland in **28** (v, 257*, 1916); Sacc. XXIV, 826. On *Laminaria*, Dorset.
— **ligniaria** (Grev.) Nits. in Fuckel, *Symb. Myc.*; Sacc. I, 269; Massee **37** (1909, 374); **5**, 235; Kirschstein **28** (XVIII, 302, 1934); *Sphaeria* Greville in **39**, t. 82, 1824; Currey **45** (XXII, 322*); **15**, 857; *Coniochaeta* Cooke in **14** (XVI, 16); Massee **14** (XVI, 37). On wood. See Chenantais **117** (XXXV, 55) for discussion of the *Coniochaeta* group of *Rosellinia*, and Kirschstein (loc. cit., p. 305) as *Helminthosphaeria*.
— **lignicola** (Cooke & Massee) Petrak & Syd. in **102** (1924, 333); *Sphaeropsis* Cooke & Massee in **14** (XVI, 8, 1887). On branches, doubtless *Quercus*. Petrak & Sydow found ascospores 6–8·5 × 5–7 μ (Cooke and Massee said 15 × 10 μ), paler and in smaller asci than those of the similar *R. pulveracea*.
— **malacotricha** (Auersw.) Niessl. Plowr. **28** (I, 63, 1899). On a conifer, Norfolk. Kirschstein (see above) transfers this to *Helminthosphaeria*.
— **mammiformis** (Pers. ex Fr.) Ces. & de Not. Massee **14** (XVI, 118, 1888); Kirschstein **28** (XVIII, 302*); *Psilosphaeria* Stevenson in **13**, 387, 1879; Bucknall **46** (v, 132); Berk. **20**, 264, 1836 as *Sphaeria*; Currey **45** (XXII, 318*); Cooke **15**, 865; Plowr. Exs. I, No. 70. On *Hedera*, etc.
[— "**mammoidea** Cooke". Recorded **28** (XII, 84) in error.]
— **mastoidea** Sacc. Grove **27** (L, 48, 1912). On wood, Studley Castle.

Rosellinia moroides (Currey) Sacc. in *Syll.* I, 262; Massee **14** (XVI, 118); *Sphaeria* Currey in **45** (XXII, 318*, 1859); Cooke **15**, 868. On wood.

— **necatrix** Prill. Massee **37** (1896, 1) "three localities in Britain"; **23** (V, 150, 1898; VII, 10; XV, 305; XVI, 389); Massee **5B**, 118*, 1899; **5**, 230; Nattrass **78** (1926, 66); **89**, 161* and 203; **64** (XXXVI, 228); **68** (1926, 66); **77** (1928–30, II, 125); **85** (XXII, 453); **79** (III, 24; V, 30; VI, 19; VII, 19 and 36; VIII, 12; XI, 46; XIII, 34); **22** (Misc. Publ. 70, p. 21, 1929); **84** (III, 188); **112**, 173. On *Pyrus*, *Ribes*, *Ulmus*, *Phaseolus*, *Arum*, *Solanum*, etc. Perithecia not known in Britain.

— **papaverea** (Berk. & Br.) Ces. & de Not. Sacc. I, 257; Massee **14** (XVI, 118, 1888); Hawley **28** (VIII, 228), note on type; *Sphaeria* B. & Br. in **19**, No. 612*, 1851; Cooke **15**, 867. On wood.

— **pulveracea** (Ehrh. ex Fr.) Fuckel. Massee **14** (XVI, 118, 1888); **37** (1909, 374); Berk. **20**, 265, 1836 as *Sphaeria*; Currey **45** (XXII, 319*); B. & Br. **19**, No. 973; Cooke **15**, 868; Cooke Exs. II, No. 681; Plowr. Exs. I, No. 75; Vize Exs. 176; *Psilosphaeria* Stevenson in **13**, 387; Bucknall **46** (III, 69, 1880); *Coniomela* Kirschstein in **28** (XVIII, 306, 1934). On bark.

— **quercina** Hartig. G. Brown **64** (XVII, 280, 1904); M. Wilson **64** (XXXVI, 227*, 1922); **76** (IV, 1, 1930). On seedlings of *Quercus*, Scotland.

— **sordaria** (Fr.) Rehm. Massee **14** (XVI, 118, 1888); Berk. **20**, 265, 1836 as *Sphaeria*; Currey **45** (XXII, 319*); Cooke **15**, 868. On *Pinus*.

— **thelena** (Fr.) Rabenh. **35** (1934, 96); Currey **45** (XXII, 315*, 1859) as *Sphaeria*; Cooke **15**, 853; Cooke Exs. 585 and II, No. 485; *Byssosphaeria* Stevenson in **13**, 385, 1879; Massee **14** (XVI, 35); Berk. **20**, 259, 1836 as *Sphaeria aquila*. On wood. See Kirschstein **28** (XVIII, 302*).

— **tunicata** Kirschst. Grove **27** (LXXI, 251, 1933); Rhodes **108** (1933, 47); *Helminthosphaeria* Kirschst. in **28** (XVIII, 305, 1934). On *Quercus*.

— **velutina** Fuckel. Kirschstein **28** (XVIII, 305, 1934, transferred to *Helminthosphaeria*). On *Fagus*, Richmond Park, Surrey and near Birmingham. Reported also in **28** (IX, 9) from Keswick Foray, 1922.

Sordaria anserina (Ces. in Rabenh.) Wint. Massee & Salmon **33** (XV, 334*, 1901). On dung, Kew.

— **arenicola** Grove in **27** (LXVIII, 66, 1930). On sand, Lancs.

— **bombardioides** Auersw. Massee & Salmon **33** (XVI, 73, 1902); Wheldon **27** (L, 184, 1912). On dung.

— **carbonaria** (Phill. & Plowr.) Sacc. in *Syll.* I, 233; **14** (XVI, 119); *Sphaeria* Phill. & Plowr. in **14** (II, 188*, 1874); Plowr. Exs. II, No. 58; *Psilosphaeria* Cooke & Plowr. in **14** (VII, 85); *Podospora* A. L. Smith in **27** (XXXIV, 359). On burnt ground near Shrewsbury. See Winter in Rabenh. *Krypt.-Fl.* II, 236. Cain thinks it belongs to *Entosordaria*. See *Lasiosphaeria ambigua* below.

— **caudata** (Currey) Sacc. in *Syll.* I, 236; Bucknall **46** (III, 268); Massee **14** (XVI, 119); *Sphaeria* Currey in **45** (XXII, 320*, 1859); B. & Br. **19**, No. 1333*, 1871; Cooke **15**, 869; Plowr. Exs. II, No. 60; *Podospora* A. L. Smith in **27** (XXXIV, 359). On old wood.

— **coprophila** (Fr.) Ces. & de Not. Bucknall **46** (III, 69, 1880); Massee **14** (XVI, 119, 1888); B. & Br. **19**. No. 596, 1851 as *Sphaeria*; Cooke **15**, 866; Vize Exs. 392; *Lasiosordaria* Chenan. in **117** (XXXV, 78). On dung. Kirschstein transferred this to *Bombardia*, and Cain follows him. See *Bovilla Capronii* above.

— **coronifera** Grove in **27** (LIV, 185*, 1916). On dung, near Birmingham.

— **curvicolla** Wint. Massee & Salmon **27** (XV, 337*, 1901). On dung, Kew.

— **curvula** de Bary. Stevenson **13**, 394, 1879; Bucknall **46** (III, 138, 1881); **32** (XXXII, 176) spore discharge, also **33** (XV, 338*; XLII, 567); **14** (XVI, 119); Plowr. Exs. III, No 43; Cooke **14** (IV, 113, 1876) as *Sphaeria*; Cooke Exs. 587; Plowr. Exs. I, No. 74 as *S. stercoraria*, corrected in Cent. III to *S. curvula*. On dung. Massee and Crossland **7**, 230 record form *coronata* Wint.

— **curvula** var. **aloides** (Fuckel) Wint. Cooke Exs II, No. 682; Cooke **14** (V, 63, 1876) as *Sphaeria*. On dung.

Sordaria decipiens Wint. Massee **14** (XVI, 119, 1888); **33** (XV, 343; XVI, 58 and 74); **7**, 230; Cooke Exs. II, No. 683. On dung.

— **fimiseda** Ces. & de Not. Phill. & Plowr. **14** (VI, 28, 1877); Stevenson **13**, 393, 1879; Massee **14** (XVI, 119); **33** (XV, 340); **32** (XXXII, 184) as *Podospora*. On dung.

— **fimiseda** var. **appendiculata** (Auersw.) Wint. Massee & Salmon **33** (XV, 340*, 1901). On dung.

— **globosa** Massee & Salm. in **33** (XV, 334*, 1901); Sacc. XVII, 602. On dung.

— **hirta** Hansen. Massee & Salmon **33** (XV, 336*, 1901). On dung, Kew.

— **lignicola** Fuckel. Grove **27** (L, 48, 1912; LXVIII, 65). On wood, Worcs.

— **macrospora** Auersw. Massee & Salmon **33** (XV, 339*, 1901). On dung. Saccardo places this and the next species in *Hypocopra*.

— **minima** Sacc. & Speg. Massee & Salmon **33** (XV, 335*, 1901). On dung, Kew.

— **minuta** Fuckel. Massee **14** (XVI, 119); **33** (XV, 342); **28** (XX, 186*) as *Podospora*. On dung.

— **neglecta** Hansen. Massee & Salmon **33** (XV, 339*, 1901); **7**, 230. On dung.

— **sparganicola** Plowr. apud Bucknall in **46** (III, 268*, 1882, with description); redescribed by Phill. & Plowr. in **14** (XIII, 76, 1885); Sacc. *Addit. I–IV*, 39; Massee **14** (XVI, 119); *Podospora* A. L. Smith in **27** (XXXIV, 359, 1896). On *Sparganium* near Bristol.

— **sparganicola** var. **velata** Bucknall in **46** (V, 46* and 52, 1886); Sacc. IX, 489. On Umbelliferae, Bristol.

— **squamulosa** Crouan. Massee & Crossland **7**, 231, 1905. On dung, Yorks.

— **tetraspora** Wint. Phill. & Plowr. **14** (VI, 28, 1877) as *S. minuta* f. *tetraspora*; **46** (III, 138*); Plowr. Exs. III, No. 45. On dung. Cain considers this a distinct species.

— **Winterii** Karst. Massee & Salmon **33** (XV, 340*, 1901). On dung.

Thamnomyces hippotrichoides (Sowerby) Ehrenb. gen.nov. ex Fr. in *Systema*, Index; Berk. **18**, 385, 1860; Tul. **114** (II, 21); Cooke **15**, 792*; **14** (XV, 39); *Sphaeria* Sowerby in **42**, t. 200, 1799 as "*hypotrichoides*"; Berk. **20**, 284, 1836; **19**, No. 94, 1838; *Xylaria* Sacc. in Syll. I, 344. On old sacks, etc.

Ustulina vulgaris Tul. in **114** (II, 23, 1863); Cooke **15**, 793; **14** (XV, 34); Wilkins **28** (XVIII, 320; XX, 133; XXII, 47); **107**, 3; Cooke Exs. II, No. 465; Vize Exs. 156; Plowr. Exs. I, No. 15; *Sphaeria maxima* Bolton in **111**, t. 181, 1791; Sowerby **42**, t. 338, 1801; Hooker **92**, 5, 1821 as *S. deusta* Hoffm.; Berk. **20**, 240; Currey **45** (XXII, 268*); *Nemania deusta* S. F. Gray gen.nov. in *Nat. Arr. Brit. Pls.* I, 516, 1821; *Stromatosphaeria deusta* Greville in **51**, 355, 1824; *Hypoxylon deustum* Greville in **39**, t. 324, 1828; Berk. **18**, t. 24, 1860 as *H. ustulatum* Bull.; Miller **28** (XV, 143*, 1930). Common on deciduous trees, found once on *Taxus*. The valid specific epithet is *deusta* (*Sphaeria deusta* Hoffm. ex Fr.).

Xylaria bulbosa (Pers. ex Fr.) Berk. & Br. in **18**, 385*, 1860; Tul. **114** (II, 20, 1863); Sacc. I, 340; 15, 791; Massee **14** (XV, 33); Rabenh. *Herb. Myc.* II, No. 133, 1860, coll. Broome. Amongst leaves of conifers. See Petch **35** (1939, 157) for *Xylaria*.

— **carpophila** (Pers. ex Fr.) Fr. Berk. **18**, 384, 1860; Cooke **15**, 790; **14** (XV, 34); **7**, 216; **65** (XXXII, 380); Cooke Exs. 364; Plowr. Exs. I, No. 14; Berk. **20**, 235, 1836 as *Sphaeria*; Currey **45** (XXII, 264*). On beech mast.

— **corniformis** Fr. Berk. **18**, 384, 1860; Cooke **15**, 789; Massee **14** (XV, 33); **7**, 216. On branches. Doubtful; see *X. longipes*.

— **Culleniae** Berk. & Br. Massee **37** (1907, 240) reported it as an introduced species not uncommon on bamboo, Kew.

— **digitata** (Linn. ex Fr.) Greville in **51**, 356, 1824; Sacc. I, 339; Bucknall **46** (III, 68, 1880); Massee **14** XV, 32; Berk. **20**, 234, 1836 as *Sphaeria*; Currey **45** (XXII, t. 45). On worked timber.

— **filiformis** (Alb. & Schw. ex Fr.) Fr. Massee **14** (XV, 33, 1886); **7**, 216. On dead leaves.

Xylaria Hypoxylon (Linn. ex Fr.) Greville in **51**, 355, 1824; Currey **45** (XXII, 264*); Berk. **18**, 384*; Tul. **114** (II, 10); **60** (1871, 77*) Cooke **15**, 790; **14** (XV, 34); **64** (XVII, 344); Baxter Exs. 74; Plowr. Exs. I, No. 13; Vize Exs. 273; Cooke Exs. 363 and II, No. 215; Lightfoot **95** (II, 1059, 1777) as *Clavaria*; Sowerby **42**, t. 55, 1796 as *Sphaeria*; **92**, 4; **20**, 235; *S. ramosa* Dickson in **44** (IV, t. 12, 1801); *Fungus ramosus* [etc.] Ray 1696, teste Tul. Common on stumps, etc.

— **longipes** Nits. Plowr. **28** (I, 61*, 1899); Berk. Exs. 277 as *Sphaeria corniformis*, teste Miller in Chardon & Toro, *Mycolog. Explor. Venezuela*, 1934, p. 217. On branches. See also Appendix I.

— **Oxyacanthae** Tul. Petch **35** (1939, 159). On fallen fruits of *Crataegus*, Yorks.

— **pedunculata** (Dickson ex Berk.) Fr. in *Summ. Veg. Scan.* p. 382; Sacc. I, 332; Berk. **18**, 385, 1860; Tul. **114** (II, 17, 1863); **15**, 790; **14** (XV, 34); **33** (XV, 351, 1901, type re-examined); Plowr. Exs. III, No. 16; *Sphaeria* Dickson in **44**, 27*, 1801; Berk. **19**, No. 93, 1838; Sowerby **42**, t. 437, 1815; Currey **45** (XXII, 262*, 1858; Berk. **31** (1854, 100*); **31** (Apr. 15*, 1871); Berk. Exs. 168. From dung. Berkeley (**20**, 235, 1836) at first considered this a var. of *X. Hypoxylon*, but later (*Mag. Zool. Bot.* 1838, 223*) found it distinct.

— **polymorpha** (Pers. ex Fr.) Greville in **51**, 35*, 1824; **39**, t. 237, 1826; Sacc. I, 309; Tul. **114** (II, 7, 1863); Cooke **15**, 789*; **14** (XV, 33); **34** (XX, 123, black lines); Vize Exs. 274, 496, 497; Plowr. Exs. I, No. 12; Cooke Exs. 484 and II, No. 214; Hooker **92**, 4, 1821 as *Sphaeria*; Berk. **20**, 234, 1836; Currey **45** (XXII, 263*; XXV, 240); ?*S. digitata* Sowerby in **42**, t. 69, 1797. Common on stumps, etc. Forms such as "var. *pistillaris*" (Foray 1916) are sometimes recorded. See Ramsbottom, *Handbook of the Larger British Fungi*.

— **scotica** Cooke in **14** (IV, 112*, 1876); Sacc. I, 319; Stevenson **13**, 369, 1879; **18A**, 361; **14** (XV, 33). On the ground, Scotland. Petch **35** (1939, 158), says that this and the next are *X. digitata*.

— **tortuosa** Sowerby ex Cooke in **14** (VIII, 10, 1879); Sacc. I, 320; **18A**, 361; **14** (XV, 33). On the ground, London.

— **Tulasnei** Nits. Cooke & Plowr. **14** (VII, 79, 1879, considered hardly distinct from *X. pedunculata*); **14** (XV, 34); Plowr. **28** (I, 61*) cites Rabenh. Exs. 636 from Broome; *X. pedunculata pusilla* Tul. in **114** (II, 18, 1863). On soil.

— **vaporaria** Berk. apud Currey in **45** (XXIV, 157*, 1863); Sacc. I, 341; B. & Br. **19**, No. 1095, 1865; Cooke **15**, 791; **14** (XV, 33); **31** (1879, 801*); **56** (LIX, 235); **50** (XXVII, 829); **23** (XLII, 119); **85** (XXXI, 16; XXXIII, 37; XXXV, 27; XXXVII, 27; XXXIX, 23); **89**, 108*. From sclerotia in mushroom beds. Petch **35** (1939, 158) regards this as a syn. of *X. pedunculata*.

SPHAERIACEAE: HYALODIDYMAE

Apioporthe vepris (de Lacr.) Wehmeyer in **28** (XVII, 289, Mar. 1933) and Monog. p. 221, Dec. 1933; Massee **14** (XVI, 13, 1887) as *Diaporthe*; **37** (1909, 374); Grove **27** (LXVIII, 71, 1930, considered it a form of *D. insignis*, but Wehmeyer places the latter with *D. pardalota*); Cooke **15**, 888, 1871 as *Sphaeria*; Plowr. Exs. II, No. 71; *S. Rubi* Currey in **45** (XXII, 325*, 1859); Massee **14** (XV, 118) as *Diaporthe nidulans*; Rilstone **27** (1935, 103); Bucknall **46** (V, 47* and 51, 1886) as *Valsa nidulans*; Plowr. Exs. III, No. 63 as *Diaporthe rostellata*. On *Rubus*. See note under *Diaporthe* below.

Bertia lichenicola de Not. Cooke **14** (I, 156, 1873) as *Sphaeria* (apparently comb. nov.); *Psiolosphaeria* Cooke & Plowr. in **14** (VII, 85, 1879); Stevenson **13**, 389, 1879; Massee **14** (XVI, 117). On a lichen, Scotland. Keissler **119**, 320 transfers it to *Rhagadostoma*.

— **moriformis** (Tode ex Fr.) de Not. Hawley **35** (1912, 342) and **28** (VIII, 227, 1923) with spores finally 3–7 septate; Grove **27** (LXVI, 356); *Psilosphaeria* Stevenson in **13**, 386, 1879; **14** (XVI, 117); **7**, 229; Hooker **92**, 8, 1821 as *Sphaeria*; Berk. **20**, 265; Currey **45** (XXII, 317*); Cooke **15**, 861; Cooke Exs. 586 and II, No. 487; Vize Exs. 175; Plowr. Exs. I, No. 67; *S. claviformis* Sowerby in **42**, t. 337, 1801 and *S. rubiformis* Sow. in **42**, t. 373; *S. rugosa* Greville in **39**, t. 39, 1823. Common on wood.

Boydia remuliformis A. L. Smith gen.nov. in **28** (VI, 151*, 1919); Sacc. XXIV, 683; **37** (1920, 216). On *Ilex*, Ayrshire and Kew. See *Vialaea insculpta* below.

Calyculosphaeria collapsa (Romell) Fitzpatrick in **100** (1923, 52); Massee **28** (I, 24, 1897) as *Bertia*; Hawley **28** (VIII, 227, said to be a form of *Melanopsamma pomiformis*). On *Ribes*.

— **tristis** (Fuckel) Fitzpatrick gen.nov. in **100** (1923, 48), based on Rabenh. *Fungi Europ.* No. 632, issued 1864, marked *Sphaeria tristis* Tode, coll. C. E. Broome, England. Fitzpatrick cites also Vize Exs. 391. But he considers *S. tristis* Tode to be a *Chaetosphaeria*, so some of the following British records must be considered doubtful: **19**, No. 181, 1841; B. & Br. **19**, No. 618, 1852, and No. 1332, 1871; Currey **45** (XXII, 315*); Cooke **15**, 855; Plowr. **14** (II, 45); *Byssosphaeria* Cooke in **14** (XV, 122); Massee **14** (XVI, 35); **7**, 226. On wood, associated with members of the Diatrypaceae. See also *Chaetosphaeria phaeostroma*.

Ceriosporella Polygoni A. L. Smith & Ramsb. in **28** (IV, 325, 1914); Sacc. XXIV, 962. On *Polygonum*, Ayrshire.

Coleroa Alchemillae (Greville) Wint. in Rabenh. *Krypt.-Fl.* II, 199, 1885; *Asteroma* Greville in **51**, 369, 1824; *Dothidea* Berk. in **20**, 288; Cooke **15**, 929 as *Stigmatea* Fr.; Cooke Exs. II, No. 698; *Venturia* B. & Br. in **19**, No. 1493, 1875; Sacc. I, 593; **14** (IV, 68; VII, 89; XVI, 38); **13**, 409. On *Alchemilla*.

— **atramentaria** (Cooke) Schroet. in *Krypt.-Fl. Schles.* II, p. 296; *Venturia* Cooke in **40** (I, 192, 1872) and **14** (I, 175, 1873); Sacc. I, 590; **27** (XI, 32, 1873); **14** (VII, 88; XVI, 38); **13**, 410; Cooke Exs. 599 and II, No. 583. On *Vaccinium*.

— **Chaetomium** (Kunze ex Fr.) Rabenh. Berk. **19**, No. 200, 1841 as *Dothidea*; Cooke **15**, 929 as *Stigmatea*; **13**, 368; Vize Exs. 199; Plowr. Exs. II, No. 98; Massee **14** (XVI, 38) as *Venturia Kunzei* Sacc. On *Rubus*.

— **Potentillae** (Sowerby ex Fr.) Wint. in Rabenh. *Krypt.-Fl.* II, 199; *Sphaeria* Sowerby in **42**, t. 370, 1802; *Dothidea* Fr. in *Syst.* II, 563; Berk. **20**, 288; Cooke **15**, 929 as *Stigmatea*; Cooke Exs. 174; Plowr. Exs. II, No. 99; *Venturia* Cooke in **14** (VI, 76*, 1877) and Exs. II, No. 587; Sacc. I, 594; **14** (XVI, 38); Vize Exs. 488. On *Potentilla*.

Cryptodiaporthe Aesculi (Fuckel) Petrak in **102** (XIX, 119, 1921); Wehmeyer **28** (XVII, 287, 1933) and Monog. p. 209; *Valsa Hippocastani* Cooke in **14** (XIII, 98, 1885); **14** (XV, 118); Vize Exs. 597 (cited by Wehmeyer); *Diaporthe Hippocastani* (Cooke) Berl. & Vogl. in Sacc. *Addit. I–IV*, 105; *Valsa aesculicola* Cooke in **14** (XIV, 47, 1885); *Diaporthe aesculicola* Berl. & Vogl. in Sacc. *Addit. I–IV*, 105. On *Aesculus Hippocastanum*. See note under *Diaporthe* below.

— **Aubertii** (Westend.) Wehmeyer in Monog. p. 202; no British specimen cited, but *Diaporthe Wibbei* is cited as a synonym: for this see Phill. & Plowr. **14** (VI, 26, 1871); Massee **14** (XVI, 13); Foray 1912 (Appendix I). On *Myrica gale*.

— **castanea** (Tul.) Wehmeyer in **28** (XVII, 284, 1933) and Monog. p. 205, Dec. 1933; Grove **27** (LXXI, 254, 1933) as *Diaporthe*; Rhodes **108** (1933, 48). On *Castanea*, Arundel and Worcs.

— **hranicensis** (Petrak) Wehmeyer in **28** (XVII, 288, 1933) and Monog. p. 214, Dec. 1933. On *Tilia*, Oscott College near Birmingham and Richmond Park, Surrey.

— **hystrix** (Tode? ex Fr.) Petrak in **102** (XIX, 119, 1921); Wehmeyer **28** (XVII, 285, 1933) and Monog. p. 207; ?Berk **20**, 244, 1836 as *Sphaeria*; Ellis **28** (V, 228) as *Diaporthe longirostris* (Tul.) Sacc. On *Acer Pseudoplatanus*. See also *Peroneutypa heteracantha*.

— **Lebiseyi** (Desm.) Wehmeyer in **28** (XVII, 280, 1933) and Monogr. p. 192, Dec. 1933. Lectotype cited by Wehmeyer as Herb. Berk. Sheet 2372 in Kew Herb. as *Sphaeria blepharodes* Berk. & Br. (in **19**, No. 978*, 1861); Cooke **15**, 882; Bucknall **46** (IV, 201, 1885); Cooke Exs. II, No. 244 (cited by Wehmeyer); Plowr. Exs. II, No. 69; *Diaporthe blepharodes* (Berk. & Br.) Sacc. in *Syll.* I, 678; Massee **14** (XVI, 14). On *Acer*.

— **pyrrhocystis** (Berk. & Br.) Wehmeyer in **28** (XVII, 286, 1933) and Monog. p. 208, Dec. 1933. Lectotype cited as Rabenh. *Fungi Europ.* No. 136 [Ser. II,

1860, coll. Broome] issued as *Diatrype* B. & Br. (in **19**, No. 841*, 1859); Cooke **15**, 814; **40** (VII, 89); Plowr. *Sphaer. Brit.* I, No. 35 (also cited by Wehmeyer); Cooke Exs. 241; Massee **14** (xv, 69); *Diaporthe* Fuckel in *Symb. Myc.* p. 204; Sacc. I, 624. On *Corylus*.

— **Robergeana** (Desm.) Wehmeyer in Monog. p. 200: British collection not mentioned, but Cooke **14** (XIV, 7, 1885) records it as *Valsa*; Massee **14** (xv, 118). On *Staphylea*.

— **salicella** (Fr.) Petrak (exclud. diag.) in **102** (XIX, 182, 1921); Wehmeyer **28** (XVII, 281) and Monog. p. 193. Wehmeyer cites Plowr. Exs. II, No. 67 issued as *Sphaeria salicella* and Exs. II, No. 44 issued as *Diaporthe spina*. The following doubtless refer in part to the next entry: Berk. **20**, 278, 1836 as *S. salicella*; Cooke **15**, 886; Massee **14** (XVIII, 11) as *Endophlaea*, Phill. & Plowr. **14** (III, 126, 1875) as *Diaporthe spina*; Cooke Exs. II, No. 489; Massee **14** (XVI, 14). On *Salix*. See *Didymella Salicis*.

— **salicina** (Currey) Wehmeyer in **28** (XVII, 282, 1933) and Monog. p. 194, Dec. 1933. Wehmeyer includes the following: Cooke Exs. II, No. 246 as *Sphaeria salicella*; Vize Exs. 180; four packets in Kew, including type, of *Valsa punctata* Cooke and two specimens ex Herb. Mason. *V. punctata* was described in **14** (XIV, 47, 1885); Massee **14** (xv, 118); *Diaporthe* Berl. & Vogl. in Sacc. *Addit. I–IV*, 108. Wehmeyer lists as a synonym *D. sphingiophora* (Oudem.) Sacc. [*Endophloea* Cooke in **14** (XVII, 89), Massee **14** (XVIII, 11), Cooke **14** (XIV, 7) as *Sphaeria*, but this record, on *Cornus*, is doubtless wrong.] *C. salicina* is recorded on *Populus* and *Salix*.

Diaporthe Nits. emend. Wehmeyer. *Diaporthe* Nitschke was first published in Fuckel, *Symb. Myc.* p. 203, 1869, as "*Diaporthe* Nitschke *Pyr. germ.* I, p. 240", but p. 161 et seq. of Nitschke's book did not appear until 1870.

For British species see **28** (XVII, 237–95, Mar. 1933), and the Monograph "The Genus *Diaporthe* Nitschke and its segregates", Univ. Michigan Press, Dec. 1933. Wehmeyer segregated as genera *Diaporthopsis*, *Apioporthe*, *Diaporthe*, *Diaporthella* and *Cryptodiaporthe*, and reduced many specific names to synonomy. Species in these genera except *Diaporthe* are here arranged as suggested by Wehmeyer, but since so many of the British records in *Diaporthe* are based on specimens that he had no opportunity of examining, the records are included under the published names, followed in brackets by the names Wehmeyer gives, if different. We have not attempted to disentangle the Exsiccati records so they are mostly not listed.

— **Aceris** Fuckel (*D. varians*). Cooke Exs. II, No. 685; Massee **14** (xv, 117, 1887) as *Valsa*; Bucknall **46** (v, 131, 1887). On *Acer*.

— **acus** (Bloxam) Cooke in **14** (VII, 81, 1879) (*Gnomonia* sp.). Sacc. I, 653; Bucknall **46** (IV, 201, 1885); Massee **14** (XVI, 12); *Sphaeria* Bloxam apud Currey in **45** (XXII, 325*, 1859); Cooke **15**, 894. On *Rumex*.

— **adunca** (Rob. in Desm.) Niessl (*D. Arctii*). Massee **14** (XVI, 12, 1887). On *Plantago*.

— **Ailanthi** Sacc. (*D. medusaea*). Cooke **14** (XIII, 98, 1885) as *Valsa*; **14** (xv, 118). On *Ailanthus*.

— **alnea** Fuckel (*D. eres*). Massee **14** (XVI, 14, 1887). On *Alnus*.

— **ambigua** Nits. (*D. eres*). Massee **37** (1915, 104*); **5** (2nd ed. p. 4 appendix). On fruit trees. Massee claimed that *Coniothecium chomatosporum* Corda was a stage of *D. ambigua*.

— **americana** Speg. (?*D. eres*). Rhodes **108** (1933, 48). On *Magnolia*.

— **Arctii** (Lasch) Nits. Wehmeyer **28** (XVII, 242), Monog. p. 22; Phill. & Plowr. **14** (VI, 26, 1877); **14** (VII, 82; XVI, 12); Bucknall **46** (IV, 201); Grove **27** (1916, 187). On *Arctium*, etc.

— **Aucubae** Sacc. Cooke & Plowr. **14** (VII, 81, 1879); Massee **14** (XVI, 12); Rhodes **108** (1933, 48). On *Aucuba*.

— **Badhami** (Currey) Cooke & Plowr. in **14** (VII, 81, 1879) (*D. eres*), Stevenson **13**, 373, 1879; Sacc. I, 635; Massee **14** (XVI, 12); *Sphaeria* Currey in **45** (XXII, 270*, 1858); *Diatrype* B. & Br. in **19**, No. 836, 1859; Cooke **15**, 815. On branches, Scotland.

Diaporthe Beckhausii Nits. Wehmeyer, Monog. p. 131. Bucknall **46** (v, 48 and 51, 1886); Massee **14** (xvi, 14); Rhodes **108** (1933, 48); Cooke Exs. 672 as *Valsa*. On *Viburnum*.

— **Carpini** (Pers. ex Fr.) Fuckel. Wehmeyer, Monog. p. 165. Massee **14** (xv, 117, 1887) as *Valsa*; Christy **62** (xii, 83) as *D. Betuli*. On *Carpinus*.

— **Cerasi** Fuckel (*D. eres*). Massee **14** (xvi, 13, 1887). On *Prunus*.

— **ceuthosporoides** (Berk.) Sacc. in *Syll.* i, 646 (*D. pardalota*). Massee **14** (xvi, 12, 1887); *Sphaeria* Berk. in **20**, 258, 1836; Cooke **15**, 895; **19**, No. 179, 1841; *Hypospila* Cooke in **14** (xiii, 105, 1885); **7**, 220. On *Prunus Laurocerasus*.

— **Chailletii** Nits. Wehmeyer **28** (xvii, 244); Monog. p. 45; Phill. & Plowr. **14** (viii, 106, 1880); Massee **14** (xvi, 13). On *Atropa*.

— **ciliaris** (Currey) Sacc. in *Syll.* i, 676 (*D. eres*). Massee **14** (xvi, 14, 1887); *Sphaeria* Currey in **68**A (vii, 231, 1859); Cooke **15**, 880. On *Fraxinus*.

— **circumscripta** (Fr.) Otth in Fuckel (*D. spiculosa*). Bucknall **46** (v, 48, 85, 1886); Massee **14** (xvi, 14); Vize Exs. 596; Cooke **15**, 834, 1871 as *Valsa*. On *Sambucus*.

— **conjuncta** (Nees ex Fr.) Fuckel. Grove **1** (i, 183) on *Corylus*; Massee **14** (xv, 117, 1887, as *Valsa* "on *Rubus*"). A doubtful species.

— **conorum** (Desm.) Niessl (*D. eres*). Hahn **28** (xv, 51, 1930). On conifers, Britain.

— **controversa** (Desm.) Nits. (*D. eres*). Hawley **28** (viii, 229, 1923); **65** (xxxii, 341); B. & Br. **19**, No. 602, 1851 as *Sphaeria*; Cooke **15**, 824, 1871 as *Valsa*; Bucknall **46** (iii, 69). On *Fraxinus*, etc.

— **coramblicola** (Berk. & Br.) Sacc. in *Syll.* i, 623 (*D. Arctii*). Massee **14** (xvi, 13); *Diatrype* B. & Br. in **19**, No. 1725, 1878. On *Brassica*.

— **Corni** Fuckel (*D. pardalota*). Massee **14** (xvi, 14, 1887); Rhodes **108** (1933, 48); Vize Exs. 590. On *Cornus*.

— **Crataegi** (Currey) Nits. in Fuckel, *Symb. Myc.* p. 204; Wehmeyer **28** (xvii, 268), Monog. p. 150; Sacc. ix, 710; *Sphaeria* Currey in **45** (xxii, 278*, 1858); *Valsa* B. & Br. in **19**, No. 848, 1859 and No. 1986, 1882; Cooke **15**, 833; Massee **14** (xv, 119); *Pseudovalsa* Cooke in **14** (xiv, 48). On *Crataegus*.

— **crustosa** Sacc. & Roum. (*D. eres*). Bucknall **46** (v, 127* and 131, 1887); Rilstone **27** (1935, 103); **35** (1913, 27). On *Ilex*.

— **cryptica** Nits. (*D. eres*). Massee **14** (xvi, 12, 1887). On *Lonicera*.

— **culta** Sacc. & Speg. Rhodes **108** (1933, 48); Rilstone **27** (1935, 103). On *Jasminum*. Probably a form of *D. eres*.

— **decedens** (Fr.) Fuckel. Wehmeyer **28** (xvii, 265) and Monog. p. 129; Berk. **19**, No. 24, 1837 as *Sphaeria*; Cooke **15**, 881; Bucknall **46** (iii, 138); Massee **14** (xv, 118, host cited in error as "elm") as *Valsa*; **7**, 223. On *Corylus*.

— **decorticans** (Lib.) Sacc. & Roum. (*D. Padi*). Recorded **28** (vii, 8, 1921) on *Prunus Cerasus*, Minehead Foray.

— **delitescens** Bomm. Rouss. & Sacc. Grove **27** (1930, 275). On *Liriodendron*, Cornwall. Probably *D. eres*.

— **Desmazierii** Niessl (*D. Arctii*). Massee **14** (xv, 13, 1886). On *Prunella*.

— **detrusa** (Fr.) Fuckel. Wehmeyer Monog. p. 175; A. Lorrain Smith **28** (iii, 117); Berk. **19**, No. 18, 1837 as *Sphaeria*; Currey **45** (xxii, 275*); Cooke **15**, 837, 1871 as *Valsa*; Massee **14** (xv, 119); Bucknall **46** (v, 131). On *Berberis*.

— **discors** Sacc. (*D. Arctii*). Bucknall **46** (iv, 201, 1885); Massee **14** (xvi, 12). On *Rumex*.

— **discrepans** Sacc. (*D. Arctii*). Bucknall **46** (v, 127* and 131, 1887). On *Rumex* near Bristol.

— **discutiens** (Berk.) Sacc. in *Syll.* i, 677 (*D. eres*). Massee **14** (xvi, 14, 1887); Bucknall **46** (v, 132); *Sphaeria* Berk. in **20**, 245, 1836; Currey **45** (xxii, 274*); Cooke **15**, 881. On *Ulmus*.

— **enteroleuca** (Currey) Sacc. in *Syll.* i, 612 (*D. oncostoma*); *Sphaeria* Currey in **45** (xxii, 275*, 1858), and perhaps in part the following: Berk. **20**, 247, 1836 as *Sphaeria* Fr.; Cooke **15**, 834 as *Valsa*; Massee **14** (xv, 118). On *Robinia*.

Diaporthe eres Nits. Wehmeyer **28** (XVII, 248) and Monog. p. 63; **65** (XXII, 341). Wehmeyer lists 20 host genera for Britain and many synonyms, those for British records being noted herein. The type host is *Ulmus*.

— **eumorpha** (Dur. & Mont.) Maire. Wehmeyer **28** (XVII, 248) and Monog. p. 60. On *Vinca*.

— **Euphorbiae** (Cooke) Cooke in **14** (VII, 82, 1879) (*D. pardalota*); Massee **14** (XVI, 13); Rhodes **108** (1933, 48); *Sphaeria* Cooke in **14** (III, 67, 1874); Cooke Exs. 674 and II, No. 238. On *Euphorbia*.

— **exasperans** Nits. (*D. eres*). Rea & Hawley **71** (XXXI, Part 13, p. 7, 1912). On *Betula*, Clare Island.

— **extensa** (Fr.) Sacc. (*D. fibrosa*). Berk. **20**, 247, 1836 as *Sphaeria*; Currey **45** (XXII, 275*); Cooke **15**, 830 as *Valsa*; **14** (XV, 118); var. *Rhamni* also in Berk. **20** and Cooke **15**. On *Rhamnus*. The records on "mountain ash" presumably refer to *D. impulsa*.

— **faginea** (Currey) Sacc. in *Syll.* I, 619 (*D. eres*, first referred to *D. medusaea*); *Sphaeria* Currey in **45** (XXII, 281*, 1858); *Valsa* B. & Br. in **19**, No. 864, 1859; Cooke **15**, 833; **14** (XV, 118). On *Fagus*, Eltham Grove.

— **fibrosa** (Pers. ex Fr.) Nits. in Fuckel. Wehmeyer **28** (XVII, 274) and Monog. p. 173; Berk. **20**, 247, 1836 as *Sphaeria*; Currey **45** (XXII, 273*); Cooke **15**, 831, 1871 as *Valsa*; **14** (XV, 118). On *Rhamnus catharticus*; recorded on *Prunus spinosa* in error.

— **furfuracea** (Fr.) Sacc. (a *Melanconis*?). Berk. **20**, 251, 1836 as *Sphaeria*; Cooke **15**, 832 as *Valsa*; **14** (XV, 118). On *Betula*.

— **fuscidula** (Cooke) Berl. & Vogl. in Sacc. *Addit. I IV*, 106 (*D. leiphaemia*). *Valsa* Cooke in **14** (XIV, 48, 1885); **14** (XV, 118). On *Quercus*.

— **Garryae** Grove in **27** (LXXI, 255*, 1933). On *Garrya*.

— **glyptica** (Berk. & Currey) Sacc. (*D. tessella*). Massee **14** (XV, 118, 1887) as *Valsa*; Grove **1** (I, 104). On *Salix*. Described **14** (IV, 100, 1876) from North America.

— **Hederae** Wehmeyer in **28** (XVII, 263, 1933) and Monog. p. 186. Type specimen on *Hedera*, Box Hill, Surrey.

— **Hippophaës** Bomm. Rouss. & Sacc. Grove **27** (LXXI, 256, 1933). On *Hippophaë*, Cornwall.

— **ilicina** Cooke in **14** (XVIII, 74, 1890) (*D. pardalota*); Sacc. IX, 711; nom. nud. Cooke in Exs. II, No. 490 and **14** (VII, 81, 1879); Bucknall **46** (III, 138, 1881); Massee **14** (XVI, 12); Plowr. Exs. III, No. 40; Vize Exs. 183 and 393. On *Ilex*.

— **importata** Nits. (*D. eres*). Phill. & Plowr. **14** (VIII, 107, 1880); Massee **14** (XVI, 14). On *Lycium*.

— **impulsa** (Cooke & Peck) Sacc. Wehmeyer **28** (XVII, 273, 1933), Monog. p. 171. On *Pyrus Aucuparia*, King's Lynn foray, incorrectly listed **28** (XVI, 4) as *D. patria*.

— **inaequalis** (Currey) Nits. in *Pyr. Germ.* p. 285, 1870; Wehmeyer **28** (XVII, 270) and Monog. p. 156; Sacc. I, 663; Cooke & Plowr. **14** (VII, 87, 1879); Bucknall **46** (V, 51, 1886); Massee **14** (XVI, 13); Rhodes **108** (1933, 48); *Sphaeria* Currey in **45** (XXII, 270, 1858); *Diatrype* B. & Br. in **19**, No. 837, 1859; Cooke **15**, 813; Cooke Exs. 372. On *Ulex* and *Cytisus*.

— **incarcerata** (Berk. & Br.) Nits. in *Pyr. Germ.* p. 270 (*D. eres*). Bucknall **46** (IV, 201, 1885); **14** (XVI, 13); Vize Exs. 592; *Diatrype* B. & Br. in **19**, No. 842, 1859; Cooke **15**, 814. On *Rosa*.

— **incrustans** Nits. (*D. eres*). Plowr. **28** (I, 64, 1899). On *Brassica*.

— **inquilina** (Fr.) Nits. (*D. Arctii*). Cooke & Plowr. **14** (VII, 81, 1879); **14** (XVI, 12); Berk. **20**, 276, 1836 as *Sphaeria*; Currey **45** (XXII, 325*); Cooke **15**, 883; Grove **1** (I, 86); Vize Exs. 182; Cooke Exs. II, No. 491. On *Conium*.

— **insignis** Fuckel (*D. pardalota*). Crossland **35** (1913, 27 and 174). On *Rubus*. See *Apioporthe vepris* above.

— **intermedia** Sacc. (probably *D. Arctii*). Grove **27** (1930, 273). Immature on *Saponaria*, Worcs.

Diaporthe juglandina (Fuckel) Nits. (*D. medusaea*). Massee **14** (xvi, 13, 1887). On *Juglans*.

— **Labiatae** (Cooke) Cooke in **14** (vii, 82, 1879) (*D. Arctii*); *Sphaeria* Cooke in **14** (v, 63, 1876); Sacc. I, 656. On *Prunella*.

— **Laschii** Nits. (*D. eres*). Cooke **14** (iii, 68, 1874); Bucknall **46** (iv, 59, 1883); **14** (xvi, 14); Cooke Exs. 682 and ii, No. 235. On *Euonymus*.

— **leiphaemia** (Fr.) Sacc. Wehmeyer **28** (xvii, 275) and Monog. p. 176; Chesters & Croxall **113** (1937, 152*); Berk. **20**, 250, 1836 as *Sphaeria*; Currey **45** (xxii, 278*); Tul. **114** (ii, 197, 1863) as *Valsa*; Massee **27** (xx, 310); **14** (xv, 118); Cooke Exs. 255 and ii, No. 225; Vize Exs. 165; Currey **45** (xxii, 276*, 1858) and B. & Br. **19**, No. 849* in error as *Sphaeria* (*Valsa*) *taleola*. On *Quercus*.

— **Leycestriae** Grove in **27** (lxviii, 274, 1930). On *Leycesteria*, Cornwall.

— **lirella** (Fr.) Nits. in Fuckel (?*Hypospila*, see Wehmeyer Monog. p. 258). **35** (Sept. 1881); **14** (xvi, 14); **7**, 225; Vize Exs. 593; Cooke Exs. 273 and ii, No. 239; Berk. **20**, 273, 1836 as *Sphaeria*; Cooke **15**, 894; Berk. Exs. 37. On *Spiraea*.

— **Mahoniae** Speg. forma **foliicola** Grove in **27** (lxxi, 256, 1933); Rhodes **108** (1933, 48). On *Mahonia*, Worcs. Wehmeyer places *D. Mahoniae* as a syn. of *D. detrusa*.

— **Malbranchei** Sacc. (*D. eres*). Hawley **28** (viii, 229, 1923). On *Ulmus*, Sussex.

— **medusaea** Nits. Wehmeyer **28** (xvii, 260) and Monog. p. 101. See *D. Ailanthi*, *juglandina*, *rudis* and *viticola*. Massee **14** (xvi, 12) records *D. medusaea* on *Rubus*, doubtless in error. See also *D. faginea*.

— **neglecta** (Duby ex Cooke) Berl. & Vogl. in Sacc. *Addit. I–IV*, 108 (*D. inaequalis*); *Valsa* Duby ex Cooke in **14** (xiv, 47, 1885). On *Genista*.

— **Niesslii** Sacc. (*D. pustulata*). See Appendix I. On *Acer Pseudoplatanus*.

— **nobilis** Sacc. & Speg. Grove **27** (lxxi, 256, 1933). On *Laurus*, Cornwall.

— **nucleata** (Currey) Cooke in **14** (vii, 81, 1879) (*D. eres*); Stevenson **13**, 373, 1879; Sacc. I, 617; *Sphaeria* Currey in **45** (xxii, 270*, 1858); *Diatrype* B. & Br. in **19**, No. 833, 1859; Cooke **15**, 815; **14** (xv, 69); Cooke Exs. 455 and ii, No. 671. On *Ulex*.

— **obscurans** Sacc. (*D. eres*). Phill. & Plowr. **14** (xiii, 77, 1885); **14** (xvi, 13). On *Fraxinus*, Scotland.

— **obsoleta** Sacc. Phill. & Plowr. **14** (vi, 26, 1877); **14** (vii, 82; xvi, 13). On *Hypericum*, Shrewsbury.

— **occulta** (Fuckel) Nits. (*D. eres*). Massee **14** (xvi, 12); Cooke **14** (iii, 68, 1874) as *Sphaeria*; Cooke Exs. ii, No. 236. On scales of *Pinus*; see Hahn **28** (xv, 48).

— **oncostoma** (Duby) Fuckel. Wehmeyer **28** (xvii, 267) and Monog. p. 141; Cooke Exs. ii, No. 240; Cooke **15**, 834, 1871 as *Valsa*; Massee **14** (xv, 118). On *Robinia*.

— **ophites** Sacc. (*D. eres*). Cooke **14** (xiii, 99, 1885); **14** (xvi, 14). On *Hibiscus*, Kew.

— **Orobanches** Berl. Grove **27** (lxxi, 257, 1933). On *Orobanche*, Wilts.

— **orthoceras** (Fr.) Nits. Cooke **14** (v, 64, 1876); **14** (vii, 82; xvi, 12); Vize Exs. 192; Cooke Exs. ii, No. 500. "On *Achillea* etc." (Wehmeyer places *D. orthoceras* on *Achillea* as *D. Arctii* var. *Achilleae*). Rhodes **108** (1933, 49) records *D. orthoceras* on *Tanacetum*.

[— **Padi** Otth. See *D. decorticans*.]

— **pardalota** (Mont.) Nits. in Fuckel. Wehmeyer **28** (xvii, 245) and Monog. p. 50, 57; Cooke & Plowr. **14** (vii, 82); **14** (xvi, 14); Cooke Exs. ii, No. 687; Berk. **19**, No. 99, 1838 as *Sphaeria*; Currey **45** (xxii, 285); Cooke **15**, 895. On *Convallaria*.

— **patria** Speg. Hawley **28** (viii, 229, 1923). On *Pyrus Aucuparia*. (Either the host or the fungus was misidentified.)

— **perexigua** Sacc. (probably *D. Arctii*). Grove **27** (1930, 295); Rilstone **27** (1935, 102). On *Carlina*, Cornwall.

Diaporthe perniciosa Marchal (*D. eres*). Dorothy M. Cayley **34** (x, 253, 1923, on *Prunus*, probably first British record, xii, 29 on *Pyrus*); **33** (xliii, 417*, saltation; xliv, 350; xlvii, 385; xlviii, 69); **77** (1928–30, ii, 146, on *Juglans*); **78** (1925, 83; 1927, 93); **79** (v, 29; xi, 50; xii, 25); **85** (xxviii, 50; xxxv, 22); **104** (iv, 162; ix, 245; xiii, 144); **24** (xii, 208); **65** (xxx, 339); **66** (ccxxiiiB, 121); **28** (x, 101; xii, 70 on *Syringa*); **112**, 203. Commonly reported in recent years.

— **Phillyreae** Cooke in **14** (vii, 81, 1879) (*D. eres*). Sacc. i, 674; Massee **14** (xvi, 13). On *Phillyrea*, Kent.

— **pinophylla** (Plowr. & Phill.) Sacc. in *Syll.* i, 646 (*D. eres*). Massee **14** (xvi, 12); *Sphaeria* Plowr. & Phill. in **14** (iv, 124*, 1876); *Gnomonia* Cooke & Plowr. in **14** (vii, 88, 1879). On leaves of *Pinus sylvestris*.

— **pithya** Sacc. (*D. eres*). M. Wilson, *Forestry Comm. Bull.* 6, 1925. On *Pseudotsuga* and *Abies*.

— **protracta** Nits. (*D. eres*). Phill. & Plowr. **14** (vi, 26, 1877); **14** (vii, 81); **46** (iv, 201); Massee **14** (xvi, 12, "on elm"). On *Acer*.

— **pulchra** (Currey) Sacc. in *Syll.* i, 617; *Sphaeria* Currey in **45** (xxii, 279*, 1858, "perithecia imperfect"); *Valsa* B. & Br. in **19**, No. 858, 1859; Cooke **15**, 832; **14** (xv, 118). Host unknown.

— **pulla** Nits. Wehmeyer **28** (xvii, 262) and Monog. p. 115; Bucknall **46** (iv, 201, 1885); **14** (xvi, 12); Rhodes **108** (1933, 49); Vize Exs. 594; Cooke **15**, 882, 1871 as *Sphaeria spiculosa* var. *pulla*. On *Hedera*.

— **pustulata** (Desm.) Sacc. Wehmeyer **28** (xvii, 269) and Monog. p. 153; Grove **27** (1918, 291); Chesters & Croxall **113** (1937, 152*); Bucknall **46** (iv, 59*, 1883) as *Valsa*; Phill. & Plowr. **14** (xiii, 77); **7**, 223. On *Acer Pseudoplatanus*.

— **putator** Nits. (*D. eres*). Phill. & Plowr. **14** (vi, 26, 1877); **14** (vii, 81; xvi, 14). On *Populus*.

— **quadrinucleata** (Currey) Stevenson in **13**, 374, 1879; Sacc. i, 689 (*D. eres*). Massee **14** (xvi, 14); *Sphaeria* Currey in **45** (xxii, 325*, 1859); Cooke **15**, 887. On *Fraxinus*.

— **Quercus** Fuckel (*D. eres*). Bucknall **46** (v, 127* and 131, 1887). On *Quercus*.

— **resecans** Nits. (*D. eres*). Massee **14** (xvi, 13); **7**, 225; Hawley **28** (viii, 229); Phill. & Plowr. **14** (iv, 124, 1876) as *Sphaeria*; Cooke & Plowr. **14** (vii, 83) as *Valsa*; Cooke Exs. 492 as *V. Syringae*. On *Syringa* and (teste Hawley) on *Forsythia*.

— **retecta** Fuckel & Nits. (*D. eres*). Hawley **28** (viii, 229, 1923). On *Buxus*, Lincs.

— **revellens** Nits. (*D. eres*). Bucknall **46** (v, 47 and 51, 1886); Massee **14** (xvi, 13). On *Corylus*, Bristol.

— **Rhois** Nits. (*D. eres*). *Valsa Rhois* Cooke nom. nud. in Exs. 245 and ii, No. 228. On *Rhus*. See Wehmeyer Monog. pp. 92, 214, and Cooke **15**, 834 in error as *Valsa stilbostoma*.

— **rudis** (Fr.) Nits. (*D. medusaea*). Massee **14** (xvi, 13, 1887); **7**, 225; Rilstone **27** (1935, 102). On *Cytisus Laburnum*.

— **Rumicis** Nits. ex Plowr. nom. nud. in Exs. iii, No. 41 and in **14** (viii, 107, 1880) (*D. Arctii*). On *Rumex*.

— **Ryckholtii** (Westend.) Nits. (*D. eres*). Phill. & Plowr. **14** (vi, 26, 1877); **14** (vii, 81; xvi, 14). On *Symphoricarpos*.

— **samaricola** Phill. & Plowr. in **14** (iii, 126, 1875) (*D. eres*). Sacc. i, 646; **14** (vii, 81; xvi, 12); **7**, 225. On *Fraxinus*.

— **Sarothamni** (Auersw.) Nits. Wehmeyer **28** (xvii, 264) and Monog. p. 120; Phill. & Plowr. **14** (vi, 26, 1877); **14** (vii, 81; xvi, 13); **7**, 225. On *Sarothamnus*.

— **Sarothamni** var. **Dulcamarae** (Nits.) Wehmeyer in **28** (xvii, 264, 1933) and Monog. p. 121; Phill. & Plowr. **14** (vi, 26, 1877) as *D. Dulcamarae*; **14** (vii, 82; xvi, 13); **27** (1935, 103). On *Solanum Dulcamara*.

— **scandens** Sacc. & Speg. (*D. Arctii*). Grove **27** (lxviii, 70, 1930). On *Tamus*, Worcs.

Diaporthe scobina Nits. (*D. eres*). Cooke **14** (VII, 81); Massee **14** (XVI, 14); **7**, 225; **65** (XXXII, 341); Cooke **14** (III, 67, 1874) as *Sphaeria*; Cooke Exs. 673 and II, No. 237; Vize Exs. 194. On *Fraxinus*.

Skimmiae Grove in **27** (LXXII, 257, 1933). On *Skimmia*.

— **Sorbariae** Nits. (*D. eres*). Rilstone **27** (1935, 103). On *Spiraea*, Cornwall.

— **sorbicola** (Nits.) Bref. (*D. impulsa*). Rhodes **108** (1933, 49). On *Pyrus Aucuparia*.

— **spiculosa** ([Alb. & Schw.]) Nits. Wehmeyer **28** (XVII, 261) and Monog. p. 110; Massee **14** (XVI, 12); Berk. **20**, 245, 1836 as *Sphaeria* (doubtful); Currey **45** (XXII, 274*, 1858); Cooke **15**, 882. On *Sambucus*. There is uncertainty about the correct name, since *Sphaeria spiculosa* Pers. ex Fr. is not the same.

— **stictostoma** (Ellis) Sacc. (the type specimen is a *Cryptosporella*). Grove **27** (LIV, 185*, 1916). On *Pyrus*.

— **striaeformis** (Fr.) Nits. (*D. pardalota*). Massee **14** (XVI, 14); **7**, 225; Berk. **20**, 256 as *Sphaeria*; Cooke **15**, 808 as *Dothidea*; Cooke Exs. II, No. 686 as *Diaporthe Epilobii*; **14** (VII, 82; XVI, 14); Bucknall **46** (V, 132); Vize Exs. 591; Cooke **14** (V, 63) as *Sphaeria Epilobii*. On *Epilobium*.

— **strumella** (Fr.) Fuckel. Wehmeyer **28** (XVII, 272) and Monog. p. 168; Berk. **20**, 244, 1836 as *Sphaeria*; Currey **45** (XXII, 272*); Cooke **15**, 814, 1871 as *Diatrype*; **14** (XV, 69); Vize Exs. 157; Cooke Exs. 236 and II, No. 670. On *Ribes*.

— **syngenesia** (Fr.) Fuckel. Wehmeyer **28** (XVII, 271) and Monog. p. 167; Currey **45** (XXII, 275*, 1858) as *Sphaeria*; Cooke **27** (IV, 99) as *Diatrype*, host said to be "elder"; Massee **14** (XV, 71 and 118) p.p. as *Valsa*; Cooke **15**, 816 as *Diatrype Frangulae*. On *Rhamnus Frangula*. See *Peroneutypa heteracantha*.

— **taleola** (Fr.) Sacc. Wehmeyer **28** (XVII, 278) and Monog. p. 181; **89**, 211*; Chesters **113** (1936, 130*); Berk. **20**, 249, 1836 as *Sphaeria*; Cooke **15**, 835 as *Valsa*; **14** (XV, 118); Cooke Exs. II, No. 231; Tul. **114** (II, 168, 1863) as *Aglaospora*; *Diatrype sordida* B. & Br. in **19**, No. 838; Currey **66** (CXLVII, 550*, 1857) and **45** (XXII, 276*) in error as *Sphaeria angulata*, corrected **45** (XXV, 246). On *Quercus*.

— **tamaricina** Sacc. & Flag. Grove **1** (I, 229, 1935). On *Tamarix*, Cornwall. Perithecial material in W. B. Grove's Herbarium.

— **tessella** (Pers. ex Fr.) Rehm. Wehmeyer **28** (XVII, 277) and Monog. p. 179; Grove **27** (XXIII, 132*, 1885); Massee **14** (XV, 70) as *Valsa*. On *Salix*.

— **tessera** (Fr.) Fuckel (*D. decedens*). Massee **14** (XV, 118, 1887) as *Valsa*, probably in error since he lists *Salix* as host.

— **tortuosa** (Fr.) Sacc. (*D. spiculosa*). Massee **14** (XV, 118, 1887) as *Valsa*. "On branches." A doubtful record.

— **Tulasnei** Nits. (*D. Arctii*). Bucknall **46** (V, 127* and 131, 1887); **14** (XVI, 13); Grove **27** (L, 48, 1912). On *Urtica*, etc.

— **varians** (Currey) Sacc. in *Syll.* I, 614; Wehmeyer **28** (XVII, 270) and Monog. p. 156; *Sphaeria* Currey in **45** (XXII, 270*, 1858); *Diatrype* B. & Br. in **19**, No. 834, 1859; Cooke **15**, 813; Massee **14** (XV, 69). On *Acer campestris*.

— **velata** (Pers. ex Fr.) Nits. (*D. eres*). Massee **14** (XVI, 14); Sowerby **42**, t. 372, 1802 as *Sphaeria*; Berk. **20**, 246, 1836 and **19**, No. 19, 1837; Currey **45** (XXII, 273*); Cooke **15**, 880. On *Tilia*.

— **Veronicae** Rehm (*D. eres*). Grove **27** (1933, 258); Rilstone **27** (1935, 103). On *Veronica*.

— **Vincae** (Cooke). Cooke in **14** (VII, 82, 1879) (*D. eumorpha*). Sacc. I, 656; Massee **14** (XVI, 13); *Sphaeria* Cooke in **14** (V, 63, 1876) and Exs. II, No. 493; Vize Exs. 293. On *Vinca*.

— **viridarii** Sacc. (*D. eres*). Cooke **14** (XIV, 7, 1885); Rilstone **27** (1935, 102). On *Prunus Laurocerasus*.

— **viticola** Nits. (*D. medusaea*). Rilstone **27** (1935, 103). On *Vitis*, Cornwall.

Didymella applanata (Niessl) Sacc. in *Syll.* I, 546; **23** (XIV, 163); **71** (XLII, 50); **77** (1925, 82; 1926–7, 84; 1932, 84); **79** (II, 18 and 31; XI, 53); **85** (XXII, 474); **93**, 160; *Didymosphaeria* Niessl in **105** (1875, 149); *Sphaeria* Phill. & Plowr. in **14** (III, 126, 1875); Cooke **14** (V, 63); Plowr. Exs. II, No. 84 (apparently

type collection); *Endophlaea* Cooke in **14** (xvii, 88; xviii, 11). On *Rubus*. Niessl did not give a locality, but evidently Plowright sent him specimens. See Petrak **102** (1923, 19) re *Didymella*.

Didymella Bryoniae (Fuckel) Rehm. Massee **14** (xviii, 41); Cooke **14** (iii, 68, 1874) as *Sphaeria*; **14** (vi, 27; vii, 87); Plowr. Exs. iii, No. 64; Vize Exs. 193; Cooke Exs. ii, No. 575. On *Bryonia*.

— **caulicola** (Moug.) Sacc. Grove **27** (lxxi, 254, 1933), says it is an immature state of *Mycosphaerella sagedioides*, q.v. On *Dipsacus*, Evesham.

— **commanipula** (Berk. & Br.) Sacc. in *Syll.* i, 556; Massee **14** (xviii, 41, 1885); *Sphaeria* B. & Br. in **19**, No. 645*, 1852; Cooke **15**, 908; Stevenson **13**, 404; Corner **28** (xix, 284) as *Didymosphaeria*. On capsules of *Scrophularia*.

— **Corni** ([Sowerby]) Sacc. in *Syll.* i, 547; Rhodes **108** (1933, 48); *Sphaeria* Sowerby in **42** t. 370, 1802; Berk. **20**, 276, 1836; *Endophlaea* Cooke in **14** (xvii, 88; xviii, 18); Cooke **15**, 909, 1871 as *S. Corni-sueciae* (but Currey **45**, xxii, 330, found Fries *Scl. Suec.* to be pycnidial). On *Cornus*. Fries thought *Sphaeria Corni* Sow. to be the same as *S. saepincola* Fr. B. & Br. **19**, No. 636 found no asci in Sowerby's specimen.

— **Cortadeniae** Grove in **27** (lx, 172, 1922). On *Cortadenia*, Ayrshire.

— **culmigena** Sacc. forma **endorhodia** Grove in **27** (lx, 172, 1922). On *Cynosurus*, Birmingham.

— **epipolytropa** (Mudd) Berl. & Vogl. Massee **14** (xviii, 41, 1889); A. Lorrain Smith **28** (iii, 176) as *Didymosphaeria*. On lichens. See Kiessler **119**, 453.

— **hyphenis** (Cooke) Sacc. in *Mich.* ii, 316; *Syll.* i, 560; Massee **14** (xviii, 41); Grove **27** (1922, 144); *Sphaeria* Cooke in **15**, 895, 1871. On *Pteridium*.

— **hyporrhodia** Sacc. Grove **48** (xx, 142, 1911); **28** (iii, 367). On Umbelliferae, Ireland.

— **Lycopersici** Klebahn. Pethybridge **22** (Misc. Publ. 70, p. 55, 1929); Small **82** (1925, 1926, 1927 as *Diplodina*); **112**, 188; **93**, 92 and 104; first reported under the name *Mycosphaerella citrullina* in **37** (1909, 293); **23** (xvi, 580, 1909); **32** (xii, 13, 1913). On *Lycopersicum, Capsicum,* and *Cucumis*. We have no record of perithecia.

— **nigrella** (Fr.) Sacc. B. & Br. **19**, No. 649, 1852 as *Sphaeria*; Currey **45** (xxii, 331*); Cooke **15**, 907; Cooke Exs. 393. On *Angelica*. See *Leptosphaeria nigrella*.

— **planiuscula** (Berk. & Br.) Sacc. in *Syll.* i, 553; Massee **14** (xviii, 40); *Sphaeria* B. & Br. in **19**, No. 891*, 1859; Cooke **15**, 908; Bucknall **46** (ii, 350); on herbs. Massee **14** (xviii, 58) compiled this in error as *Heptameria*.

— **proximella** (Karst.) Sacc. Phill. & Plowr. **14** (xiii, 76); Stevenson **40** (vii, 114, 1884) as *Sphaerella*. On *Carex*.

— **refracta** (Cooke) Sacc. in *Syll.* i, 560; Massee **14** (xviii, 41); *Sphaeria* Cooke in **14** (v, 119, 1877; vii, 87). On *Scirpus*.

— **rubitingens** Bloxam ex Cooke in **14** (xx, 82, 1892); Sacc. xi, 302. On herbaceous stems, Gopsall.

— **Salicis** Grove in Sacc. *Addit. I–IV*, 86 and ix, 667. On *Salix* near Birmingham. Von Höhnel considers it *Diaporthe* [*Cryptodiaporthe*] *salicella*.

— **sepincoliformis** (de Not.) Sacc. Bucknall **46** (v, 58*, 1886); **46** (iv, 202, 1885) as *Sphaeria*. On *Rosa*, near Bristol.

— **superflua** (Fuckel) Sacc. Massee **14** (xviii, 40, 1889); Cooke **15**, 907, 1871 as *Sphaeria*; Bucknall **46** (ii, 350, 1879); Plowr. Exs. ii, No. 83. On *Urtica*.

— **tosta** (Berk. & Br.) Sacc. in *Syll.* i, 556; Massee **14** (xviii, 40); *Sphaeria* B. & Br. in **19**, No. 648*, 1852; Cooke **15**, 908; Bucknall **46** (iii, 70); Cooke Exs. 266? and ii, No. 250. On *Epilobium*. Saccardo placed Plowr. Exs. ii, No. 8_ (issued as *Sphaeria tritorulosa*) as *D. Fuckeliana*, apparently a syn. of *D. tosta*. See von Höhnel, *Frag. Myc.* 1033.

Didymellina Dianthi C. C. Burt in **28** (xx, 214, 1936). On *Dianthus barbatus*, Scotland. The perfect state of *Heterosporium echinulatum*.

— **Iridis** (Desm.) von Höhnel. Phill. & Plowr. **14** (ii, 188, 1874) as *Sphaerella* Auersw.; **14** (vii, 88); Plowr. Exs. ii, No. 91. On *Iris*. This is the type species of *Didymellina*. Petrak considered it a *Mycosphaerella*.

[**Didymellina macrospora** Kleb. Only the conidial state, *Heterosporium gracile* Sacc., known in Britain. See Moore, *Diseases of Bulbs*, 1939; **112**, 189.]

Eriosphaeria inaequalis Grove in Sacc. *Addit. I–IV*, 103, 1886 and **27** (XXIV, 132, 1886) [with *Gonytrichum caesium*]; Sacc. IX, 697; *Lasiosphaeria* Cooke in **14** (XV, 125); Massee **14** (XVI, 37). On wood, Worcs. Von Höhnel **102** (1919, 121) proposed the genus *Melanopsammella* for this species.

— **investans** (Cooke) Sacc. in *Syll.* I, 598; *Sphaeria* Cooke in **15**, 855, 1871; *Byssosphaeria* Cooke in **14** (XV, 123, 1887); Massee **14** (XVI, 35); *Trichosphaeria* Lindau in *Natur. Pflanz.-Fam.* 1897, where *Eriosphaeria* is treated as a subgenus of *Trichosphaeria*. On branches, Surrey.

— **membranacea** (Berk. & Br.) Sacc. in *Syll.* I, 598; *Sphaeria* B. & Br. in **19**, No. 1493*, 1875; *Lasiosphaeria* Cooke & Plowr. in **14** (VII, 85, 1879); Massee **14** (XVI, 37); **7**, 227. On wood, Langridge.

Gibbera Vaccini (Sowerby ex Fr.) Fr. gen.nov. in *Summa*, p. 402; Cooke **15**, 843*, 1871; Sacc. I, 600; Massee **14** (XVI, 34); **37** (1909, 375, "on *Genista*"); Plowr. Exs. III, No. 26; *Sphaeria* Sowerby in **42**, t. 373, 1802; Berk. **20**, 254; Currey **45** (XXII, 319*). On *Vaccinium*.

[**Gnomonia Ariae** (DC.) Fuckel. Massee **14** (XVII, 75); **7**, 233; Cooke **15**, 911, 1871 as *Sphaeria*, "specimens immature". On *Pyrus Aria*. This name is given in Oudem. *Enumerat.* III, 503 as a syn. of *Graphiothecium parasiticum* Sacc.]

Gnomonia campylostyla Auersw. Massee **14** (XVII, 74, 1889) as *G.* "*Campylostoma*". On leaves of *Betula*.

— **cerastis** (Riess) Ces. & de Not. Crossland **35** (1913, 175); Hawley **28** (IX, 239, 1924). On peduncles of *Acer*. Auerswald cites Cooke Exs. 162, issued as *G. petioli*.

— **curvirostra** (Sowerby ex Fr.) Sacc. in *Syll.* I, 570; Massee **14** (XVII, 75); *Sphaeria* Sowerby in **42**, t. 373, 1802; Cooke **15**, 907. On some member of the Umbelliferae.

— **errabunda** (Rob. in Desm.) Auersw. Bucknall **46** (III, 70, 1880) as *Sphaerella*. On *Betula*, Bristol.

— **erythrostoma** (Pers. ex Fr.) Auersw. Carruthers **56** (XXV, 313*, 1900); **56** (XXVII, 1140); **63** (LXII, 241, 1901); **23** (XIV, 334; XVII, 895; XXXI, 361); Brooks **33** (XXIV, 585, development); **33** (XXXVI, 762); **27** (XLVI, 96); **5**, 199*; **77** (1924, 114); **79** (II, 31; V, 26; XI, 31); **85** (XV, 221*; XVI, 286; XXV, 147); **89**, 130*; **93**, 130; **112**, 197. On *Prunus*.

— **Graphis** Fuckel. Massee **14** (XVII, 75); Plowr. Exs. III, No. 89; Cooke **14** (V, 64, 1876) as *Sphaeria*. On *Rubus*.

— **herbicola** A. L. Smith in **28** (III, 221, 1910); Sacc. XXII, 302; **115**, 38. On *Epilobium*.

— **inclinata** (Desm.) Auersw. Massee **14** (XVII, 74, 1889); Hawley **28** (IX, 239); Cooke **15**, 911, 1871 as *Sphaeria setacea* var. *epiphyllae*; Plowr. Exs. I, No. 95. On *Acer*, *Aesculus*, etc.

— **leptostyla** (Fr.) Ces. & de Not. Wormald **77** (1924, 117, 1925); Hamond **77** (1928–30, II, 145, perithecia); Rhodes **108** (1933, 48). On *Juglans*.

— **Needhami** Massee & Crossl. in **35** (1904, 3); **7**, 233; Sacc. XVII, 666. On leaves of *Abies*.

— **petiolicola** (Fuckel) Karst. Massee **14** (XVII, 74); Cooke **27** (IV, 103*, 1866) as "*Sphaeria petioli* Fuckel"; 15, 911, as *S. setacea* var. *petiolae*; Plowr. Exs. I, No. 94. On petioles. See *G. cerastis*.

— **rostellata** (Fr.) Brefeld. Wehmeyer Monog. *Diaporthe* p. 266; Berk. **20**, 267, 1836 as *Sphaeria*; Cooke **15**, 907; Massee **14**, **60** (1880, 84*); (XVI, 13) as *Diaporthe*. On *Rosa* and *Rubus*. See *Apioporthe vepris*.

— **Rubi** (Rehm) Wint. Wormald **85** (XXII, 478, 1913); Dowson **56** (L, 55*, 1925); **31** (LXXXVI, 374); **93**, 201; **112**, 199. On *Rubus* and *Rosa*.

— **setacea** (Pers. ex Fr.) Ces. & de Not. Massee **14** (XVII, 74); **7**, 233; Cooke Exs. 161 and II, No. 280; Berk. **20**, 277, 1836 as *Sphaeria*; Currey **45** (XXII, 333*); Cooke **15**, 911 (with vars., see *G. inclinata* and *G. petiolicola* above); Berk. Exs. 184; Vize Exs. 190. On leaves.

Gnomonia suspecta (Fuckel) Sacc. Massee **14** (XVII, 74, 1889). On *Quercus* and *Fagus*.

— **veneta** (Sacc. & Speg.) Kleb. **65** (XXX, 349); Cooke **14** (XVI, 77, 1888) as *Sphaerella*; Massee **14** (XIX, 13) as *Laestadia*. On *Platanus*. *G. veneta* Speg. is an earlier name for a fungus on *Ostrya*, so this well-known *Gnomonia* on *Platanus* requires to be renamed.

Hercospora Tiliae (Pers. ex Fr.) Fr. emend. Tul. Cooke **15**, 833, 1871 as *Valsa*; Bucknall **46** (IV, 591); **7**, 233; Cooke Exs. 378 and II, No. 226; Plowr. Exs. I, No. 51; Vize Exs. 166; Massee **14** (XV, 119) as *Melanconis*. Cooke cites as syn. *Sphaeria tiliaginea* Currey in **66** (CXLVII, 545*, 1857), *Valsa* B. & Br. in **19**, No. 865, 1859, but Grove **1** (II, 263) places Currey's fungus as *Naemospora Tiliae* Delacr. On *Tilia*.

Lentomita ligneola (Berk. & Br.) Sacc. in *Syll.* I, 585; *Sphaeria* B. & Br. in **19**, No. 883*, 1859; Cooke **15**, 876; Bucknall **46** (II, 349); Plowr. Exs. III, No. 55; *Ceratostomella* Cooke in **14** (XVII, 49, 1889); Massee **14** (XVII, 73). On *Quercus*. The same fungus has the later name *Ceratostomella ampullasca*, and some British specimens of the same fungus are referred to the earlier *C. rostrata*.

— **stylophora** (Berk. & Br.) Sacc. in *Syll.* I, 586; *Sphaeria* B. & Br. in **19**, No. 976*, 1861; Cooke **15**, 877; *Ceratostoma* Stevenson in **13**, 385; *Ceratostomella* Cooke in **14** (XVII, 49, 1889); Massee **14** (XVII, 73). On *Acer platanoides*.

Melanconis Aceris Phill. & Plowr. in **14** (XIII, 76, 1885); Sacc. *Addit. I IV*, 104; Grove **27** (XXIII, 132*, 1885). On *Acer*.

— **Alni** Tul. Tul. **114** (II, 123, 1863); Cooke **15**, 818; Massee **14** (XV, 119); **7**, 224; Cooke Exs. 369 and II, No. 481; Vize Exs. 281; Plowr. Exs. II, No. 23; "*Sphaeria thelebola*" in **45** (XXII, 280*, 1858). On *Alnus*.

— **hyperopta** (Nits.) Wehmeyer in Monog. *Diaporthe*, p. 254. Rhodes **108** (1933, 48) as *Diaporthe carpinicola* Fuckel. On *Carpinus*.

— **modonia** Tul. in *Comp. Rend.* 1856; **114** (II, 141); Cooke **14** (III, 67, 1874); Massee **14** (XV, 119); Cooke Exs. 681 and II, No. 482; Plowr. Exs. II, No. 26; Vize Exs. 282; *Sphaeria biconica* Currey in **45** (XXII, 279*, 1858); *Valsa biconica* B. & Br. in **19**, No. 857, 1859; Cooke **15**, 832; **14** (XX, 82); *Diaporthe biconica* Sacc. in *Syll.* XI, 310; see Wehmeyer **28** (XVII, 295). On *Castanea*.

— **stilbostoma** (Fr.) Tul. Tul. **114** (II, 119, 1863); Cooke **15**, 818*; **14** (XV, 119); Chesters **113** (1938, 179*); Plowr. Exs. I, No. 40; Cooke Exs. 486 and II, No. 669; Currey **45** (XXII, 278*, 1858) as *Sphaeria*; *S. pulchella* Currey in **45** (XXII, 280) teste Tul.; *Valsa Bloxami* Cooke in **14** (XIV, 47, 1885); **14** (XV, 118); *Diaporthe Bloxami* Berl. & Vogl. in Sacc. *Addit. I–IV*, 105 and IX, 702; see Wehmeyer Monog. *Diaporthe*, p. 248. On branches.

— **sulfurea** (Fuckel) Petrak. Wehmeyer Monog. *Diaporthe*, p. 251, 268; *Valsa olviaestroma* Cooke in **14** (XIV, 48, 1885); **14** (XV, 118); compiled as "*Diaporthe elaeostroma*" Berl. & Vogl. in Sacc. *Addit. I–IV*, 107. On *Corylus* (teste Wehmeyer), Jedburgh.

— **thelebola** (Fr.) Sacc. Massee **14** (XV, 119); Currey **45** (XXII, 280*, 1858) as *Sphaeria*; Cooke **27** (IV, 100*, 1866) as *Valsa*; **15**, 835; Vize Exs. 168. On *Alnus*.

— **xanthostroma** (Mont.) Schroet. Wehmeyer Monog. *Diaporthe*, p. 247; Berk. **19**, No. 22, 1837 as *Sphaeria*; Currey **45** (XXII, 280*); Berk. Exs. 296; B. & Br. **19**, No. 861*, 1859 as *Valsa chrysostroma*, Cooke **15**, 819 as *Melanconis chrysostroma*; Massee **14** (XV, 119); *Valsa bitorulosa* B. & Br. in **19**, No. 861*, 1859; Cooke **15**, 832; Massee **14** (XV, 117 as "*tritorulosa*" in error); *Diaporthe bitorulosa* Sacc. in *Syll.* I, 608. On *Carpinus*.

Melanopsamma borealis Karst. var. **minor** (Cooke) Sacc. in *Syll.* IX, 686; *Conisphaeria borealis* (Karst.) Cooke in **14** (XVI, 87), var. *minor* Cooke in **14** (XVII, 79, 1889). On wood, Surrey.

— **pomiformis** (Pers. ex Fr.) Sacc. Berk. **20**, 264, 1836 as *Sphaeria*; Cooke **15**, 862; B. & Br. **19**, No. 1333*, 1871; Plowr. Exs. I, No. 68; *Psilosphaeria* Cooke in **14** (XVI, 50); Massee **14** (XVI, 117); *Sphaeria corona* Sowerby in **42**, t. 393, 1803. On wood. See *Calyculosphaeria collapsa*.

Melanopsamma pustula (Currey) Sacc. in *Mich.* I, 347; *Syll.* I, 576; *Sphaeria* Currey in **45** (XXII, 317*, 1859); *Psilosphaeria* Cooke in **14** (XVI, 50); *Sphaeria perexigua* Curr. apud Berk. nom. nud. in **18**, 396; Cooke **15**, 863. On wood.

— **Ruborum** (Lib.) Sacc. Cooke **27** (IV, 102, 1866) as *Sphaeria*; Cooke **15**, 863; Cooke Exs. 385; Plowr. Exs. II, No. 53; *Lasiosphaeria* Stevenson in **13**, 391; *Sphaeria rubicola* Currey in **45** (XXII, 315*, 1859). On *Rubus*.

Mycosphaerella (Sphaerella). Although we believe *Sphaerella* should, if possible, be conserved against *Mycosphaerella*, we have attempted to list the correct citations of authors under *Mycosphaerella* for species recorded from Britain. This effort has taken much time without providing any assurance that all citations are correct, and for thirteen species no transfer to *Mycosphaerella* was found. The arguments for conservation of *Sphaerella*, and the references to literature are presented in *Trans. Brit. mycol. Soc.* XXIII, 220, 1939. The transfers by Vestergren are in *Bih. K. Svenska Vet. Akad. Handl. Stockholm*, XXII, Afd. iii, No. 6 (1896). The page references for transfers from *Sphaerella* to *Mycosphaerella* are given here, since these may be found convenient.

— **allicina** (Fr.) Vestergren 1896, p. 15; *Sphaerella* Auersw. 1869; Cooke **15**, 920, 1871; Massee **14** (XIX, 43). On *Allium*, Shere.

— **aquilina** (Fr.) Schroet. 1894, p. 341; *Sphaerella* Auersw. 1869; Massee **14** (XIX, 43, 1890), on *Pteridium*, Darenth; **65** (XXX, 347, 1931) on *Polypodium*, Scotland. Saccardo (*Syll.* II, 82) placed this name as a doubtful synonym of *Leptosphaeria aquilina* Pass. See also *M. Pteridis*.

— **Ascophylli** Cotton in **28** (III, 95*, 1909); **71** (XXXI, 16, 1912); *Sphaerella* Sacc. & Trott. in *Syll.* XXII, 147, 1913. Common on *Ascophyllum nodosum*. First noted by Church **33** (VII, 399, 1893), with a brief description but no specific name.

— **atomus** (Desm.) Oudem. 1897, p. 209 (attributed to "Johanson"); *Sphaerella* Cooke in **14** (III, 69, 1874); **14**, (VII, 88; XIX, 44); Cooke Exs. 689. On leaves of *Fagus*.

— **brassicicola** (Duby) Oudem. 1897, p. 210 (attributed to "Johanson"); Grove **56** (XL, 76*); **65** (XXX, 342); **79** (I, 18 and 29; III, 5; IV, 5; V, 25; VII, 17 and 35; VIII, 10; XI, 44; XII, 28); **112**, 120; **85** (XXII, 455*; XXXIII, 19); *Sphaerella* Ces. & de Not. 1863; Cooke **27** (IV, 251*, 1866); **15**, 920; **23** (XV, 279 and 441); **56** (XXVII, 805); **89**, 82*; **14** (XIX, 42); Vize Exs. 397; Plowr. Exs. III, No. 94; first British record apparently as *Sphaeria Brassicae* (Chev.) B. & Br. in **19**, No. 656*, 1852. Common on Cruciferae.

— **carinthiaca** Jaap in **102** (VI, 210, 1908); Kathleen Sampson **26**A (Ser. 2, No. I, 1922) in Wales; **22** (Misc. Publ. 52, p. 38, 1926) in southern England; **71** (XLII, 50, 1934) in Ireland; *Sphaerella* Sacc. & Trott. in *Syll.* XXII, 128. On *Trifolium*.

— **chlouna** (Cooke) Lindau 1897, p. 426 (spelt "*chlorina*"); *Sphaerella* Cooke in **14** (V, 127, 1877); Sacc. I, 525; **14** (VII, 88; XIX, 43). A note by the collector (Dr Capron) on the type reads "I think a garden variety of *Phalaris arundinacea*", Shere.

— **clymenia** (Sacc.) Oudem. 1897, p. 217 (attributed to "Johanson"); Grove **27** (LXVIII, 69, 1930) as *M. clymenia* "Johans. & Magn."; **70** (XXII, 397). On *Lonicera*, Scotland and Ireland.

— **conglomerata** (Wallr.) Lindau 1897, p. 434; *Sphaerella* [Rabenh. 1860, *Fungi Europ.* No. 150] Auersw. 1869, p. 5; Cooke **15**, 914, 1871 and Exs. No. 500. On leaves of *Alnus*.

— **Crataegi** (Fuckel) Oudem. 1897, p. 215 (attributed to "Johanson"); *Sphaerella* Fuckel, *Fung. Rhen.* No. 2162; Cooke **15**, 913, 1871; Massee **14** (XIX, 14); Plowr. Exs. III, No. 96. On leaves of *Crataegus*.

— **cruciferarum** (Fr.) Lindau 1897, p. 424; *Sphaerella* Sacc. 1877; Berk. **19**, No. 191, 1841 as *Sphaeria*; Cooke **15**, 907. On *Erysimum*.

— **Cydoniae** Grove in **27** (LVI, 285*, 1918). On leaves of *Cydonia vulgaris*, Hereford.

— **depazeiformis** (Auersw.) Lindau 1903, p. 72; Muskett *et al.* **71** (XLII, 49, 1934). On *Oxalis acetosella*, Ireland.

Mycosphaerella Eryngii (Fr.) Oudem. 1897, p. 213 (attributed to "Johanson"); *Sphaerella* Cooke in **27** (IV, 249*, 1866); **15**, 917; B. & Br. **19**, No. 657, 1852 as *Sphaeria*. On *Eryngium*.

— **Fagi** (Auersw.) Lindau 1897, p. 424; *Sphaerella* Auersw. 1869, p. 6; Bucknall **46** (V, 54, 1886); Massee **14** (XIX, 13); Cooke Exs. 203 and II, No. 263. On *Fagus*.

— **filicum** (Desm.) Starb. 1889, p. 9; Rhodes **108** (1933, 48); *Sphaerella* Auersw. 1869; Massee **14** (XIX, 43); Plowr. Exs. III, No. 99; Phill. & Plowr. **14** (VIII, 109, 1880) as *Sphaeria* and (teste Oudem. *Enumeratio* I, 306) *Mollisia filicum* Phill. in **11**, 191. On *Dryopteris*.

— **Fragariae** (Tul.) Lindau 1897, p. 424; **85** (XXXIII, 21); **79** (I, 12 and 30; V, 26; VII, 18; IX, 24; XI, 53); **24** (XII, 207); **65** (XXX, 340); **112** 179; *Sphaerella* Sacc. 1882; **23** (V, 199, 1898; XI, 641; XIII, 498; XVII, 476); **56** (XXV, p. XXXV); **5**, 194*; **89**, 150*. On *Fragaria*.

— **hedericola** (Desm.) Lindau 1897, p. 424; *Sphaerella* Cooke in **14** (III, 69, 1874); **14** (VII, 88; XIX, 13); Vize Exs. 298. On *Hedera*.

— **idaeina** (Hazsl.) Ramsb. Recorded **28** (XXII, 10, 1938) from Killarney, 1936 Foray, as *M.* "*idaeina* (Hazsl.)". So far as we know, this is a comb.nov.

— **innumerella** (Karst.) Starb. 1889, p. 9; *Sphaerella* Karst. 1870 (*Fungi Fenn.* 965); Phill. & Plowr. **14** (VIII, 109, 1880); Massee **14** (XIX, 42); Stevenson **40** (VII, 114); Plowr. Exs. III, No. 98. On *Potentilla*.

[— **Iridis** (Auersw.) Schroet. 1894, p. 339; *Sphaerella* Auersw. 1869. See *Didymellina.*]

— **isariophora** (Desm.) Johanson 1884, p. 165; **71** (XLII, 49, 1934); *Sphaerella* Ces. & de Not. 1863; Cooke **27** (IV, 104*, 1866); **15**, 918; **14** (XIX, 43); **56** (XXVI, 655); Plowr. Exs. I, No. 97; Vize Exs. 97; Cooke Exs. 167 and II, No. 266. On *Stellaria*.

— **latebrosa** (Cooke) Schroet. 1894, p. 324; *Sphaerella* Cooke in **27** (IV, 248*, 1866); Sacc. I, 482; **15**, 915; **14** (XIX, 13); Bucknall **46** (III, 70). On *Acer Pseudoplatanus*.

— **Ligustri** (Rob. in Desm.) Lindau 1897, p. 424; *Sphaerella* Cooke in **27** (IV, 249*, 1866); **15**, 917; **14** (XIX, 13); Cooke Exs. 691. On *Ligustrum*.

— **lineolata** (Rob. & Desm.) Schroet. 1894, p. 339; *Sphaerella* Ces. & de Not. 1863; Cooke **27** (IV, 252*, 1866); **15**, 921; B. & Br. **19**, No. 616, 1852 as *Sphaeria*. On *Ammophila*.

— **maculiformis** (Pers. ex Fr.) Schroet. 1894, p. 333; Hawley **28** (IX, 239); *Sphaerella* Cooke in **27** (IV, 245* and 242, 1866, with var. *aequalis*); **15**, 912; **14** (XIX, 13); Cooke Exs. 170 and II, Nos. 273 276; Vize Exs. 400; Plowr. Exs. II, No. 87; Sowerby **42**, t. 370, 1802 as *Sphaeria*; Johnston **58**, 129, 1831; Berk. **20**, 278; **18**, 401; Berk. Exs. No. 338. On leaves. See *Sphaerella arcana* below.

— **microspila** (Berk. & Br.) Lind in *Danish Fungi* 1912, p. 208; *Sphaerella* Cooke in **27** (IV, 251*, 1866); Sacc. I, 503; **15**, 919; Vize Exs. 398; *Sphaeria* B. & Br. in **19**, No. 984*, 1861; transferred to *Stigmatea* by Niessl and to *Venturia* by Winter. On *Epilobium*.

— **millegrana** (Cooke) Schroet. 1894, p. 334; *Sphaerella* Cooke in **27** (IV, 247*, 1866); Auersw. 1869, p. 8*; Sacc. I, 485; **15**, 915; **14** (XIX, 14). On *Carpinus*.

— **oedema** (Fr.) Schroet. 1894, p. 335; *Sphaerella* Fuckel in *Symb. Myc.* 1869, p. 104; Massee **14** (XIX, 42); Cooke Exs. No. 692 and II, No. 261. On *Ulmus*.

— **Pelvetiae** Sutherland in **32** (XIX, 34*, 1915); *Sphaerella* Trotter in *Syll.* XXIV, 849, 1928. On *Pelvetia*.

— **peregrina** (Cooke) Lindau 1897, p. 424; *Sphaerella* Cooke in **14** (VII, 88, 1879); Sacc. I, 519; **14** (XIX, 43); Vize Exs. 296; Cooke Exs. II, No. 700. On *Rubia peregrina*.

— **pinodes** (Berk. & Blox.) Vestergr. 1896, p. 15; **79** (VIII, 25, 1931; XI, 49); **78** (1932, 115*); **28** (XX, 99); *Sphaerella* Niessl, 1875 in Rabenh. *Fungi Eur.* No. 1947; Sacc. I, 514; **14** (XIX, 43); *Sphaeria* Berk. & Blox. apud B. & Br. in **19**, No. 981*, 1861; Cooke **15**, 908; Plowr. Exs. I, No. 92. This species was transferred to *Didymellina* by von Höhnel in **102** (XVI, 67) and to *Didymella* by Petrak in **102** (XXII, 18). On *Pisum*.

Mycosphaerella Plantaginis (Sollm.) Vestergr. 1896, p. 15; *Sphaerella* Sollm. 1864; Massee **14** (XIX, 43, 1890). On *Plantago*, Norfolk.

— **Polypodii** (Fuckel) Oudem. 1897, p. 205 (attributed to "Johanson"); *Sphaerella* Fuckel, 1869; A. Lorrain Smith **28** (III, 42, 1908). On *Asplenium*, Scotland.

— **Primulae** (Auersw. & Heufl.) Schroet. 1894, p. 338. Listed in **108** (VIII, 109, 1930), Worcs.; see also Appendix I as *Sphaerella*.

— **Pteridis** (Desm.) Schroet. 1894, p. 341; *Sphaerella* de Not. 1863; Cooke **27** (IV, 250, 1866); **15**, 919; Massee **14** (XIX, 43); Cooke Exs. 175 and II, No. 265; Vize Exs. 300; B. & Br. **19**, No. 656, 1852 as *Sphaeria*. Auerswald, 1869, found one of Cooke's specimens to be *S.* (*Mycosphaerella*) *aquilina*, q.v. On *Pteridium*.

— **punctiformis** (Pers. ex Fr.) Starb. 1889, p. 9; *Sphaerella* [Rabenh. *Herb. Myc.* Ed. II, 264, 1856] Cooke **27** (IV, 246*, 243, 1866) for the name: the figures and description here and in **15**, 914, have been referred to *Guignardia Cookeana*, q.v.; Massee **14** (XIX, 13); the following probably belong in part to *M. punctiformis*: Johnston **58**, 130, 1831 as *Sphaeria*; Berk. **20**, 279; **18**, 401; Hooker **92**, 8, 1821 as var. *Hederae*; *Cryptosphaeria* Greville in **51**, 262, 1824; Massee **14** (XIX, 43) as *Sphaerella corylaria* (Wallr.) Fuckel; Cooke Exs. 497; Cooke **15**, 913 as *Sphaerella sparsa* Auersw.; **14** (XIX, 14); Plowr. Exs. II, No. 88; Vize Exs. 396; Cooke Exs. II, Nos. 264, 370. Common on dead leaves.

— **Rumicis** (Desm.) Grove in **27** (LXXI, 253, 1933) with f. *caulicola* f.nov.; *Sphaerella* Cooke in **27** (IV, 251*, 1866); **15**, 920; **14** (XIX, 43); Cooke Exs. 168 and II, No. 268; Plowr. Exs. II, No. 90; Vize Exs. 399; **71** (XLII, 50) as *Venturia*; B. & Br. **19**, No. 658, 1852 as *Sphaeria*; Rhodes **108** (1933, 47) as *Stigmatea*. On *Rumex*.

— **sagedioides** (Wint.) Lindau 1897, p. 424; Grove **27** (LXXI, 254*, 1933). See *Didymella caulicola*.

— **Scirpi-lacustris** (Auersw.) Lindau 1897, p. 425; *Sphaerella* Auersw. 1869; Cooke **14** (V, 121, 1877); **14** (VII, 88; XIX, 43); Plowr. Exs. III, No. 91; Vize Exs. 297. On *Scirpus*.

— **sentina** (Fr.) Schroet. 1894, p. 334; **79** (I, 30; 1924; V, 30; XI, 52); **85** (XXVIII, 50); **77** (1934, 144); *Sphaerella* Fuckel 1869; Massee **14** (XIX, 13, but the leaves in the specimen from Audley End in Herb. Kew. are not of pear). On *Pyrus communis*. The pycnidia only, *Septoria pyricola* Desm., are known in Britain.

— **tabifica** (Prill. & Del.) Lind 1913, p. 203; *Sphaerella* Prill. & Del. 1891; McWeeney **63** (VI, part 3*, 1895); **23** (XI, 488, 1904, on *Brassica campestris* in Scotland, XII, 37 on *Solanum tuberosum*, XII, 596); Cooke **89**, 245*, 1906, on *Beta*; Massee **5** A, 109, 1899; **37** (1906, 59) and **5**, 195, 1910: "conidial stage *Phoma Betae* and *Phyllosticta tabifica*"; Grove **1** (I, 68). On *Beta*. There are no definite records of perithecia in Britain. The only specimen in Herb. Kew. is marked by Massee "*Phoma* stage". Proof that *M. tabifica* is a state of *Phoma Betae* is lacking. The fungus on beet is now called *Phoma Betae*. The *Phoma* on turnip was probably *P. Lingam*; that on potato is uncertain.]

— **Tassiana** (de Not.) Johanson 1884, p. 167; Grove **27** (LXVIII, 69, 1930), on *Glyceria*; *Sphaerella* de Not. 1863; Bucknall **46** (V, 54, 1886), on *Typha*.

[— **Tulasnei** (Jancz.) Lindau 1906 in Lafar, *Handb. Tech. Mykol.* 2 Aufl. IV, 270; *Sphaerella* Jancz. 1893. The conidia only, *Cladosporium herbarum* (Pers.) Link ex Fr., recorded for Britain. Ruehle **99** (1931, 1150) in the U.S.A. has verified Janczewski's discovery of perithecia.]

— **Typhae** (Lasch) Lindau 1897, p. 425; *Sphaerella* Auersw. 1869; Massee **14** (XIX, 43, 1890); Plowr. Exs. II, No. 93. On *Typha*.

— **Vaccinii** (Cooke) Schroet. 1894, p. 335; *Sphaerella* Cooke in **27** (IV, 249*, 1866); **15**, 917; Sacc. I, 493; Massee **14** (XIX, 42); Cooke Exs. 176. On *Vaccinium*.

Sphaerella Arbuti (Fr.) Sacc. in *Syll.* I, 536; Massee **14** (XIX, 43, 1890). On *Arbutus*, Scotland.

— **arcana** Cooke in **27** (IV, 246*, 1866); **15**, 913; Sacc. I, 485; **14** (XIX, 14); Cooke **27** (IV, 245, 1866) as *S. maculiformis* var. *centigrana*; Cooke Exs. 169; Vize Exs. 197 as *S. sparsa* var. *centigrana*. On leaves of "lime and chestnut".

A note by Cooke in Herb. Kew. states that *S. arcana* "appears to have originated in error...." The specimens on which this entry is based may be in part *Mycosphaerella maculiformis*, *M. punctiformis*, or *Guignardia acerifera*.

Sphaerella brachytheca Cooke in **14** (VII, 88, 1879); Sacc. I, 494; Stevenson **13**, 408, 1879; **14** (XIX, 42). On *Vaccinium*, Scotland. This name is placed by Kirschstein (1938) as a synonym of *Mycosphaerella stemmatea* (Fr.) Romell (in *Fungi Scand.* No. 68, 1890).

— **Brassicae** T. Johnson in **25** (V, 440, 1905); not in Sacc. On *Brassica*, Ireland.

— **brunneola** (Fr.) Cooke in **15**, 922, 1871; Sacc. I, 523; **56** (XXVI, p. cxi); **14** (XIX, 43); Berk. **20**, 279, 1836 as *Sphaeria*, Cooke **27** (IV, 251); Berk. Exs. 39. On *Convallaria*, etc. Schroeter (1894, p. 339) considered this a synonym of *Mycosphaerella subradians* (Fr.) Schroet. (loc. cit.). (There is also apparently the binomial *M. brunneola* (Fr.) Allesch. & Schnabel in Exs. 537, 1897.)

— **Capronii** Sacc. in *Syll.* I, 487; Massee **14** (XIX, 14). Saccardo based his description on the record of "*S. salicicola*" in Cooke **15**, 913, 1871. On *Salix*, Surrey.

[— **cinerascens**: see *Venturia inaequalis.*]

— **Elodes** A. L. Smith & Ramsb. in **28** (V, 423, 1917). On *Hypericum Elodes*, New Forest.

— **epistroma** Cooke in **27** (XXI, 137, 1883); Sacc. II, XLII (with the well-known diatribe on Cooke's "dog-latin"). On grass.

— **erysiphina** (Berk. & Br.) Cooke in **27** (IV, 250*, 1866); **15**, 919; Sacc. I, 510; *Sphaeria* B. & Br. in **56** (IX, 67*, 1855). On leaves of *Humulus* bearing powdery mildew.

— **Hieracii** Cooke & Massee in **14** (XV, 111, 1887); **14** (XIX, 42); Sacc. IX, 620. On *Hieracium*, Kent.

— **oblivia** Cooke in **27** (IV, 246* and 242, 1866); **15**, 913; Sacc. I, 477; **14** (XIX, 13); Bucknall **46** (III, 70, 1880); Cooke Exs. 693 and II, No. 262. On *Castanea*. Referred by Auerswald (1869) to *S.* (*Mycosphaerella*) *maculiformis* as a variety.

— **Rhododendri** Cooke in **27** (XXI, 108, 1883); Sacc. II, XXXVIII. On *Rhododendron*. This name is a later homonym of *Sphaerella Rhododendri* de Not., 1863. Vize Exs. 299 was issued under the latter name. Rilstone **27** (1935, 102) reports "*Mycosphaerella Rhododendri* (Cooke) Lindau."

— **simulans** Cooke in **27** (IV, 246*, 1866); **15**, 914; Sacc. I, 478. On *Quercus*, Highgate. Auerswald (1869) considered this to be *S.* (*Mycosphaerella*) *maculiformis*, but Cooke did not agree.

Niesslia exilis (Alb. & Schw. ex Fr.) Wint. B. & Br. **19**, No. 606, 1851 as *Sphaeria*; Cooke **15**, 858; *Lasiosphaeria* Cooke in **14** (XV, 124); Massee **14** (XVI, 36). On twigs of *Pinus*. See Fitzpatrick **100** (XV, 38).

— **exosporioides** (Desm.) Wint. Massee **14** (XVI, 38) as *Venturia*; Trail **40** (X, 69); early records in error as *Venturia Chaetomium* (Corda) Ces. & de Not. [which is now considered a syn. of *N. exilis*]: Cooke **27** (IV, 244*); **15**, 923; **13**, 409; B. & Br. **19**, No. 620, 1852 as *Sphaeria Chaetomium.* On *Carex* and *Luzula*.

— **ilicifolia** (Cooke) Wint. in Rabenh *Krypt.-Fl.* II, 197, 1885; *Venturia* Cooke in **27** (IV, 245*, 1866); **15**, 924*; Sacc. I, 588; Cooke Exs. 696; **14** (VIII, 87) as "*V. ilicicola*". On *Ilex*. Winter found his specimen of Plowr. Exs. II, No. 95 issued as *V. ilicifolia*, to be something else.

Pharcidia dubiella (Nyl.) A. L. Smith in **28** (III, 177, 1910). On lichens and Moss, Scotland. See Keissler **119**, 437.

— **Pelvetiae** Sutherland in **32** (XIV, 39*, 1915); Sacc. XXIV, 893. On *Pelvetia.*

— **triphractoides** (Nyl.) A. L. Smith in **28** (III, 177, 1910); *Endococcus* Nyl. apud Crombie in **14** (III, 24, 1874). On *Lecidea*, Scotland. Keissler **119**, 423 places it as a synonym of *Phaeospora parasitica*.

Rehmiellopsis bohemica Bubák & Kab. M. Wilson & McDonald **64** (XXXVIII, 114*, 1924); **64** (XLII, 43; XLIX, 49); **65** (XXX, 348; 112, 199). On *Abies*, Scotland.

Spumatoria longicollis Massee & Salm. gen.nov. in **33** (XV, 351*, 1901; Sacc. XVI, 1134 and XVII, 663); **35** (1902, 132); **7**, 232. On dung, Essex and Yorks.

Venturia Aucupariae (Lasch) Rostrup. Phill. & Plowr. **14** (VIII, 108, 1880) as *Sphaeria*; Massee **14** (XIX, 44) as *Sphaerella*; Plowr. Exs. II, No. 92 and III, No. 65. On *Pyrus Aucuparia*. See Lind, *Danish Fungi*.—The name *Venturia* should be conserved to continue its current use, which includes neither of the original species. See **102** (XXI, 170).

— **chlorospora** (Ces.) Karst. Massee **14** (XVI, 38, 1887). On *Salix*. A doubtful record; Ainsworth **93**, 224 considers that this species has not been found in Britain.

— **Dickiei** (Berk. & Br.) Ces. & de Not. in *Schema*, p. 51; Sacc. I, 589; Cooke **27** (IV, 244*, 1866); **15**, 923; *Sphaeria* B. & Br. in **19**, No. 617*, 1852. On *Linnaea*, Scotland. Berk. **18**, 404 wrote "*Lasiobotrys Linneae* B.", apparently a nomen nudum. Schroeter in 1908 made the combination *Coleroa Linnaeae*.

— **ditricha** (Fr.) Karst. Bucknall **46** (V, 54, 1886); Massee 14 (XVI, 38); Cooke **14** (III, 68, 1874) as *Sphaerella*; **14** (VII, 68); Cooke Exs. 688; Plowr. Exs. III, No. 95. On *Alnus*.

— **eres** (Berk. & Br.) Ces. & de Not. in *Schema*, p. 51; Sacc. I, 595; Cooke **27** (IV, 244*, 1866); **15**, 923; *Sphaeria* B. & Br. in **19**, No. 621*, 1852. On *Carex*.

— **glomerata** Cooke in **14** (III, 69, 1874); Sacc. I, 592; Massee **14** (XVI, 38); Cooke Exs. II, No. 582; Plowr. Exs. II, No. 96. On *Geranium*. Winter, Rabenh. *Krypt.-Fl.* II, p. 200, makes this a synonym of *Coleroa circinans*, but Lind, *Danish Fungi*, p. 212, keeps them separate.

— **inaequalis** (Cooke) Wint. emend. Aderh. in **105** (XXXVI, 81, 1897); Sacc. I, 587; Salmon & Ware **31** (LXXV, 190*, 1924); most of the following records under this name, and many others, refer to the *Fusicladium* stage: **5**, 204*; **14** (XVI, 38); **23** (XXXI, 548; XXXIV, 528; XLI, 551); **25** (XXV, 269; XXXIV, 96); Wiltshire **34** (I, 335); **31** (various reports); **49** (II, 26); **61** (CX, 497); **78** (1914, 95 and subsequent years); **79** (I, 29; II, 15; IV, 6; XI, 50); **85** (in most reports 1906–12 and 1927–38); **93**, 131, references; **112**, 185*; Bennett, *Outlines of Fungi and Plant Diseases*, p. 150*; *Sphaerella* Cooke in **27** (IV, 248*, 1866); **15**, 916; Cooke Exs. 173; Vize Exs. 495; **23** (XV, 182) as *Valsa pomi*. On over-wintered leaves of *Pyrus Malus*. Cooke described this species on "*Pyrus Aria*, ash, hawthorn, pear, apple", from which comes the false record of *Sphaerella cinerascens* in **14** (XIX, 42); Cooke issued Exs. 690 as "*Sphaerella inaequalis* var. *Salicis*". See **28** (XX, 103) for taxonomy of *V. inaequalis*.

— **integra** Cooke in **15**, 924, 1871; Sacc. I, 596; Massee **14** (XVI, 38). On *Corylus*, Shere.

— **Johnstoni** (Berk. & Br.) Sacc. in *Mich.* II, 55; *Syll.* I, 592; Massee **14** (XVI, 38); Vize Exs. 598; *Dothidea* B. & Br. in **19**, No. 661, 1852; Cooke **15**, 806; **14** (III, 126). On *Epilobium*. Winter, Rabenh. *Krypt.-Fl.* II, 436 and Lind., *Danish Fungi*, p. 213, think this a synonym of the next.

— **maculiformis** (Desm.) Wint. Muskett *et al.* **71** (XLII, 50, 1934). On *Epilobium*, Ireland.

— **Myrtilli** Cooke in **27** (IV, 245*, 1886); **15**, 924; Sacc. I, 590; **14** (XVI, 38); **7**, 228; **70** (XXI, 389); Cooke Exs. 164 and II, No. 581; Plowr. Exs. II, No. 94. On *Vaccinium*.

— **pirina** Aderh. Perithecia reported by Salmon & Ware **31** (LXXV, 274*, 1924; XCI, 446); most of the following and many other reports are of conidia: **85** (XV, 220; XXIV, 150; XXXI to XLI); **23** (XXXI, 552*; XXXIV, 162); **25** (XXV, 272); **79** (I, 30; V, 26; XI, 52); **34** (I, 335); **93**, 122; **112**, 187. On *Pyrus communis*.

— **Thwaitesii** Massee & Crossland in **35** (1904, 3); Sacc. XVII, 651; **7**, 228. On *Rubus*, Yorks.

Vialaea insculpta (Fr. emend. Oudem.) Sacc. Phill. & Plowr. **14** (XIII, 77, 1885) as *Zignoella*. On *Ilex*. Grove **27** (LIX, 13*, 1921) studied specimens and decided that *Boydia remuliformis* (q.v., supra) was probably the same, and made the combination *B. insculpta* (Oudem.) Grove.

SPHAERIACEAE: PHAEODIDYMAE

Amphisphaeria paedida (Berk. & Br.) Sacc. in *Syll.* I, 724; *Sphaeria* B. & Br. in **19**, No. 1396*, 1873; Cooke **14** (II, 164*); *Conisphaeria* Cooke in **14** (VII, 86); *Melanomma* Cooke in **14** (XVI, 52 and 118). On *Fagus*, Somerset.

— **ulmicola** (Currey) Sacc. & Trav. in *Syll.* XIX, 68; *Syll.* XXII, 182; *Sphaeria* Currey in **45** (XXII, 321*, 1859). On *Ulmus*. Currey does not state that it was a British collection. No one has seen asci.

— **umbrina** (Fr.) de Not. Crossland **35** (1913, 177). On *Quercus*, Yorks.

— **ventosaria** (Lindsay) Sacc. in *Syll.* I, 729; Massee **14** (XVII, 5); Cooke **15**, 872 as *Sphaeria*; *Psilosphaeria* Stevenson in **13**, 388. On lichens. Keissler **119**, 412 places this as a synonym of *Tichothecium pygmaeum*, and gives further synonymy.

Delitschia bisporula (Crouan) Hansen. Phill. & Plowr. **14** (VI, 28, 1877); Plowr. Exs. III, No. 46; *Sordaria* Cooke & Plowr. in **14** (VII, 86); Stevenson **7**, 395; **14** (XVI, 120); Bucknall **46** (III, 138). On dung. Von Hohnel (*Fragm. Mykol.* No. 1202) suggests that this may be a *Protoventuria*.

— **insignis** Mouton. Massee & Salmon **33** (XV, 344*, 1901). On dung. Cain **100** (XXVII, 227) transfers this to *Zygospermella*.

— **Marchalii** Berl. & Vogl. Plowr. **28** (I, 63, 1899). On dung, Norfolk.

— **minuta** Fuckel. Phill. & Plowr. **14** (VI, 29*, 1877); Massee **14** (XVI, 120) as *Sordaria*; Cooke Exs. 451 as *Sphaeria*; *Sordaria minutella* Cooke & Plowr. in **14** (VII, 86, a new name being necessary in order to place the species in *Sordaria*); Stevenson **13**, 395. On dung. Petrak **102** (1924, 139) thinks *D. minuta* is probably the same as the next.

— **moravica** Niessl. Massee & Salmon **33** (XV, 343*, 1901). On dung, Surrey. Cain (*Coprophilous Sphaeriales Ontario*) makes it a synonym of *D. bisporula*.

— **Winteri** (Phill. & Plowr.) Sacc. in *Syll.* I, 734; **33** (XV, 345*); *Sphaeria* Phill. & Plowr. in **14** (II, 188*, 1874); Plowr. Exs. II, No. 59; *Sordaria* Cooke & Plowr. in **14** (VII, 85); **13**, 394; Bucknall **46** (III, 138); Massee **14** (XVI, 120). On dung.

Didymosphaeria acerina Rehm. Phill. & Plowr. **14** (VI, 27, 1877); *Sphaeria* Cooke & Plowr. in **14** (VII, 87). On *Acer*, Norfolk. Petrak **102** (1923, 329) names this *Amphisphaeria millepunctata* (Fuckel) Petrak.

— **arenaria** Mouton. Grove **27** (LXXI, 258, 1933). On *Ammophila*, Wales.

— **celata** (Currey) Sacc. in *Syll.* I, 705; Massee **14** (XVIII, 12); **7**, 233; *Sphaeria* Currey apud Berk. in **18**, 398, 1860; Cooke **15**, 880; *S. obtecta* Currey in **68**A (VII, 233*, 1859); B. & Br. **19**, No. 979, 1861. On *Ulmus*.

— **conoidea** Niessl. Cooke **14** (XIV, 41, 1885); Bucknall **46** (V, 53, 1885); **14** (XVIII, 57); A. Lorrain Smith **28** (VI, 149). On stems.

— **crastophila** Niessl var. **Brachypodii** Feltgen. O'Connor **70** (XXI, 398, 1936). On grass, Ireland.

— **diplospora** (Cooke) Rehm in **105** (1879, 167); Sacc. I, 710; Massee **14** (XVIII, 12); *Sphaeria* Cooke in **27** (IV, 102, 1866); **15**, 891; Plowr. Exs. II, No. 72. On *Rubus*. See Rhodes **108** (1933, 53).

— **dochmia** (Berk. & Br.) Sacc. in *Syll.* I, 706; Massee **14** (XVIII, 12); *Sphaeria* B. & Br. in **19**, No. 630*, 1852; Cooke **15**, 890. On "*Ulmus*", Batheaston. The host of the type collection has been determined at Kew as *Alnus*.

— **Empetri** (Fr.) Sacc. B. & Br. **19**, No. 1627, 1876 as *Sphaeria*; Cooke **14** (V, 63); **13**, 405; *Didymosphaerella* Cooke in **14** (XVIII, 29); Massee **14** (XVIII, 57). On *Empetrum*.

— **enormis** Grove in **27** (LXVIII, 71*, 1930). On *Juncus*, Borth.

— **epidermidis** (Fr.) Fuckel. Massee **14** (XVIII, 12); **37** (1909, 374); Berk. **19**, No. 186, 1841 as *Sphaeria*; B. & Br. **19**, No. 639; Currey **45** (XXII, 329*); Cooke **27** (IV, 103*); **15**, 891; *S. Araucariae* Cooke in **27** (IV, 103*, 1866); *Sphaerella Araucariae* Cooke in **27** (IV, 250) On various hosts.

— **fenestrans** (Duby) Wint. Recorded **28** (XXI, 3, 1937) on *Epilobium*, Matlock Bath Foray. Petrak **102** (1923, 30) makes this the type of the genus *Sydowiella*.

— **fucicola** Sutherland in **32** (XIV, 188, 1915); Sacc. XXIV, 927. On *Fucus*, Orkney.

Didymosphaeria futilis (Berk. & Br.) Rehm in **105** (1870, 167); Sacc. I, 712; Massee **14** (XVIII, 12); Grove **27** (LXVIII, 73); *Sphaeria* B. & Br. in **19**, No. 638*, 1852; Cooke **15**, 891. On *Rosa*.

— **microstictica** (Leighton) Wint. A. Lorrain Smith **28** (III, 176); Keissler **119**, 475, with synonymy. On lichens.

— **neottizans** (Leighton) A. L. Smith in **28** (III, 177, 1910). Rare on *Baeomyces*. Keissler **119**, 494 places this as *Leptosphaeria*.

— **oblitescens** (Berk. & Br.) Sacc. in *Syll.* I, 713; Massee **14** (XVIII, 12); *Sphaeria* B. & Br. in **19**, No. 887*, 1859; Cooke **15**, 891. On *Cornus*, Wilts.

— **palustris** (Berk. & Br.) Sacc. in *Syll.* I, 708; Massee **14** (XVIII, 57); Grove **27** (LXVIII, 73); *Sphaeria* B. & Br. in **19**, No. 654*, 1852; Cooke **15**, 898; Cooke Exs. II, No. 252; Plowr. Exs. II, No. 76. On *Carex*, etc. Von Höhnel, *Frag. Myk.* 1173 suggested a new genus, *Ceriophora*, for this species.

— **pelvetiana** Sutherland in **32** (XIV, 185*, 1915); Sacc. XXIV, 928. On *Pelvetia*, Orkney and Solent.

— **pulposi** Zopf. W. Watson **27** (LV, 316, 1917) reports this species or a closely allied one on lichens, Buckden. See Keissler **119**, 463 as *Didymella*.

— **Spartinae** Grove in **27** (LXXI, 259*, 1933). On *Spartina*, Dorset.

— **Syringae** Fabre. Grove **27** (LXVIII, 72*, 1930); Rhodes **108** (1933, 48). On *Syringa*, Worcs.

— **tenebrosa** (Berk. & Br.) Sacc. in *Syll.* I, 711; Massee **14** (XVIII, 57); *Sphaeria* B. & Br. in **19**, No. 649*, 1852; Cooke **15**, 898. On *Arctium*.

— **trivialis** (Berk. & Br.) Sacc. in *Syll.* I, 705; Massee **14** (XVIII, 11); *Sphaeria* B. & Br. in **19**, No. 632*, 1852; Cooke **15**, 890. On *Cornus*, Wilts.

— **vexata** (Sacc.) Wint. Hawley **28** (VIII, 228, 1923). On *Cornus*, Dorset. Hawley thought it might be the same as *D. trivialis*.

— **Winteri** Niessl. Phill. & Plowr. **14** (XIII, 76, 1885). On stems of *Solanum tuberosum*, Scotland.

Gibellina cerealis Pass. Mary Glynne **28** (XX, 121, 1936). On *Triticum aestivum*, Herts.

Lizonia emperigonia (Auersw.) de Not. A. Lorrain Smith **27** (XXXV, 8, 1897); **28** (I, 73). On *Polytrichum*.

Massariella bufonia (Berk. & Br.) Speg. gen.nov. in *Fungi Arg.*; Sacc. I, 716; *Sphaeria* B. & Br. in **19**, No. 629*, 1852; Currey **45** (XXII, 327*, 1859); *Massaria* Tul. in **114** (II, 236, 1863); Cooke **15**, 846; Massee **14** (XVIII, 9); Plowr. Exs. I, No. 59. On *Quercus*.

— **Curreyi** (Tul.) Sacc. in *Syll.* I, 717; *Massaria* Tul. in **114** (II, 231*, 1863); Cooke **15**, 847; Massee **14** (XVIII, 9); "*Sphaeria Tiliae*" in **45** (XXII, 327*, 1859) p.p. On *Tilia*.

— **scoriadea** (Fr.) Sacc. in *Syll.* IX, 739; Berk. **19**, No. 176, 1841 as *Sphaeria*; Currey **45** (XXII, 283*); Cooke **15**, 873; *Anthostoma* Sacc. in *Syll.* I, 302; *Massaria* Cooke in **14** (XVII, 93); Massee **14** (XVIII, 9). On *Betula*. See Jørgensen (ref. in *Rev. Appl. Myc.* X, 273).

— **vibratilis** (Fuckel) Sacc. Berk. **20**, 268, 1836 in error as *Sphaeria vibratilis* Fr.; Currey **45** (XXLI, 323*); Cooke **15**, 885; Massee **14** (XV, 117) in error as *Valsa*. On *Prunus*, Norths. See Oudem. *Enumerat.* III, 772.

Melanconiella spodiaea (Tul.) Sacc. Massee **14** (XV, 119, 1887) as *Melanconis*. On *Carpinus*, Highgate.

Neopeckia fulcita (Bucknall) Sacc. in *Syll.* IX, 750; Hawley **28** (VIII, 227); *Lasiosphaeria* Bucknall in **46** (V, 126* and 132, 1887). On *Prunus*.

Otthia Crataegi Fuckel. Cooke **14** (XVIII, 53, 1890). On *Crataegus*, Newcastle.

— **populina** (Pers. ex Fr.) Fuckel. Massee **14** (XVI, 34); Berk. **19**, No. 96, 1838 as *Sphaeria*; Cooke **15**, 842, 1871, as *Cucurbitaria*. On *Populus*. See *Teichospora obducens*.

— **Pruni** Fuckel. Massee **14** (XVI, 34, 1887). On *Prunus*, Eastbourne.

— **Syringae** (Fr.) Niessl. Niessl **105** (1876, 2) found *O. Syringae* on Cooke Exs. II, No. 18 issued as "*Diplodia Syringae*, with *Sphaeria*"; Massee **14** (XVI, 34); *Cucurbitaria* Cooke & Plowr. in **14** (VII, 83). On *Syringa*.

Phaeosphaerella macularis (Fr.) Trav. Massee **14** (xix, 14 and 42, 1890) as *Sphaerella*, "on poplar leaves, Apethorpe". There is only one specimen in Herb. Kew., marked by Currey "immature". The species was referred to *Mycosphaerella* by Schroeter in 1894.

Rhynchostoma apiculata (Currey) Wint. in Rabenh. *Krypt.-Fl.* ii, 598; *Valsaria* Sacc. in *Syll.* i, 752; *Sphaeria* Currey in **45** (xxii, 326*, 1859); Cooke **15**, 879; B. & Br. **19**, No. 1333, 1871; Cooke Exs. 272; Plowr. Exs. i, No. 80; *Xylosphaeria* Stevenson in **13**, 399, 1879; **35** (Sept. 1881); Massee **14** (xviii, 8); **7**, 233. On wood. This species was made the type of *Apiorhynchostoma* Petrak gen.nov. in **102** (1923, 185).

Tichothecium calcaricola (Mudd) Arnold. Massee **14** (xvii, 4); A. Lorrain Smith **28** (iii, 174), with synonymy. On lichens. Keissler **119**, 389 makes this a variety of *Discothecium gemmiferum*.

— **cerinarium** (Mudd) Berl. & Vogl. Massee **14** (xvii, 5); A. Lorrain Smith **28** (iii, 176). On lichens. Keissler **119**, 415 places this and the next two as *T. pygmaeum* var. *erraticum*.

— **erraticum** Massal. A. Lorrain Smith **28** (iii, 175, 1910). On lichens, Dorset. Also reported 1922 Foray.

— **erraticum** subsp. **microphorum** (Nyl.) A. L. Smith in **28** (iii, 175, 1910). On lichens.

— **gelidarium** (Mudd) Berl. & Vogl. in Sacc. *Addit. I IV*, 118; Massee **14** (xvii, 4); *Sphaeria* Mudd in *Manual*, p. 130; *Didymosphaeria* A. L. Smith in **28** (iii, 176). On lichens.

— **gemmiferum** (Taylor) Koerb. Wint. **105** (1886, 16); Sacc. ix, 725; Massee **14** (xvii, 4); A. Lorrain Smith **28** (iii, 174). On lichens. Keissler **119**, 385 follows Vouaux in placing this in *Discothecium*.

— **leucomelarium** (Mudd) Berl. & Vogl. Massee **14** (xvii, 5); *Sphaeria* Mudd in *Manual*, p. 105. On lichens. Keissler **119**, 494 follows Vouaux in placing this in *Leptosphaeria*.

— **perpusillum** (Nyl.) Arnold. Massee **14** (xvii, 4); A. Lorrain Smith **28** (iii, 174). On lichens. Keissler (**119**) considers this a synonym of *Discothecium gemmiferum* var. *calcaricola*.

— **pygmaeum** Koerb. Massee **14** (xvii, 5, 1888); A. Lorrain Smith & Rea **28** (ii, 61). On lichens. See Keissler **119**, 411.

— **pygmaeum** var. **ventosicola** (Mudd) Wint. A. Lorrain Smith **28** (iii, 175, 1910). Keissler does not recognise this variety as distinct.

— **rimosicola** (Leighton) Arnold. Sacc. ix, 727; Massee **14** (xvii, 5); A. Lorrain Smith **18** (iii, 175). This is placed by Keissler **118**, 420 as a synonym of *Phaeospora parasitica* (Loennr.) Arnold.

— **squamarioides** (Mudd) Wint. in **105** (1886, 17); Sacc. ix, 725; Massee **14** (xvii, 5); A. Lorrain Smith **28** (iii, 176). On lichens. Keissler **119**, 403 transfers this to *Discothecium*.

Valsaria anserina (Pers. ex Fr.) Sacc. B. & Br. **19**, No. 889, 1859 as *Sphaeria*; Cooke **15**, 879; *Xylosphaeria* Cooke in **14** (xvii, 86); Massee **14** (xviii, 8). On *Salix*, etc.

— **Caproni** (Cooke) Berl. & Vogl. in Sacc. *Addit. I–IV*, 131; *Pseudovalsa* Cooke in **14** (xiv, 48, 1885); **14** (xv, 120). On wood, Shere.

— **cincta** (Currey) Sacc. in *Syll.* i, 742; *Sphaeria* Currey in **45** (xxii, 277*, 1858); *Diatrype* B. & Br. in **19**, No. 846, 1859; Cooke **15**, 816; **14** (xv, 69); Plowr. Exs. ii, No. 22; Niessl **105** (1874, 130). On *Fagus*, Surrey.

— **insitiva** Ces. & de Not. Recorded **28** (vii, 8). See Appendix I.

— **Parmularia** (Berk.) Sacc. Cooke **15**, 836, 1871 as *Valsa*; Massee **14** (xv, 119) as *Pseudovalsa*. On *Quercus*. Described by Berkeley from France.

— **rubricosa** (Fr.) Sacc. Currey **45** (xxii, 266*, 1858) as *Sphaeria*; *Melogramma* Tul. in **114** (ii, 84); Phill. & Plowr. **14** (vi, 25); **14** (xv, 39); Plowr. Exs. iii, Nos. 18, 19. On *Fagus*, etc.

[**Xylobotryum caespitosum** A. L. Smith in **28** (iii, 331*, 1912); Sacc. xxiv, 1294; *Sphinctrina* Phill. nom. nud. in **31** (Aug. 7, 1878). On an old fungus, Hereford. The figure represents a Discomycete.]

SPHAERIACEAE: HYALOPHRAGMIAE

It might be better to place all the British Phragmosporae in one series; *Zignoella* and *Melanomma* at any rate cannot accurately be separated on spore colour.

Acanthostigma parasiticum (Hartig) Sacc. "H. W." **64** (XLVII, 71, 1933) as *Trichosphaeria*. On *Abies*, Scotland. Perithecia not mentioned.

Broomella Vitalbae (Berk. & Br.) Sacc. gen.nov. in *Syll.* II, 558; Petch **27** (LXXIV, 185); *Hypocrea* B. & Br. in **19**, No. 829*, 1859; Tul. **114** (III, XV); Cooke **15**, 775; **14** (XV, 4); Rabenh. *Fungi Eur.* 43, coll. Broome. On *Clematis Vitalba*, Batheaston. Von Hohnel, *Fragm. Myc.* 1147, thought *Ceriospora xantha* Sacc. the same. See Bucknall **46** (V, 48*, 53) for a record as *C. xantha*.

[— **leptogicola** (Cooke & Massee) Sacc. in *Syll.* IX, 989; *Hypocrea* Cooke & Massee in **14** (XIX, 86). A lichen, teste Petch **27** (LXXIV, 185).]

Calospora alnicola (Cooke & Massee) Sacc. in *Syll.* IX, 872; *Valsa* Cooke & Massee in **14** (XVI, 47, 1887); *Massarina* Berl. in **98** (I, 118*). On *Alnus*, Kew.

— **platanoides** ([Pers.]) Niessl. **70** (XXI, 399); Cooke **15**, 837 as *Valsa*; Massee **14** (XV, 119); **7**, 223; Plowr. Exs. II, No. 38; Berk. **20**, 251, 1836 as *Sphaeria stilbostoma* var. *platanoides*; Currey **45** (XXII, 278*); *S. Innesii* Currey in **45** (XXII, 281*); *Valsa Innesii* B. & Br. in **19**, No. 863, 1859; Cooke **15**, 838; Tul. **114** (II, 201); Massee **14** (XV, 119); *Calospora Innesii* Sacc. in *Syll.* II, 231. On *Acer Pseudoplatanus*.

?— **undulata** (Berk. & Br.) Sacc. in *Syll.* II, 233; "*Diatrype*" in **19**, No. 831, 1859; Massee **14** (XV, 69). On *Hedera*. Berkeley & Broome found 3-septate spores, and Saccardo thought it might belong to a new genus, but Berlese **98** (I, 117) found *Diatrype* (see *D. stigma*) on the specimen he examined.

Ceratosphaeria crinigera (Cooke) Sacc. in *Syll.* II, 227; Berl. **98** (I, 91*); *Sphaeria* Cooke in **14** (I, 156, 1873); Plowr. Exs. I, No. 78; *Ceratostoma* Cooke in **14** (VII, 84); **13**, 385; *Ceratostomella* Cooke in **14** (XVII, 49); **14** (XVII, 73). On wood of *Pinus*.

— **lampadophora** (Berk. & Br.) Niessl gen.nov. in *Not. Pyr.*, 1876; Sacc. II, 227; Berlese **98** (I, 90*); *Sphaeria* B. & Br. in **19**, No. 882*, 1859; Cooke **15**, 877; *Ceratostomella* Cooke in **14** (XVII, 49); Massee **14** (XVII, 73). On wood.

— **ordinata** (Fr.) Kirschst. B. & Br. **19**, No. 973*, 1861 as *Sphaeria*; Cooke **15**, 863; Rabenh. *Fungi Europ.* No. 329, coll. Broome; Massee **14** (XVII, 6) as *Winteria*; **7**, 232. On *Quercus*.

— **rhenana** (Auersw.) Wint. Hawley **28** (VIII, 228, 1923). Dorset [on *Salix*?].

Cryptoderis riparia (Niessl) Sacc. Grove **27** (XXIV, 132, 1886, on *Epilobium*); A. Lorrain Smith **28** (III, 117, 1909) as *Gnomonia*, on "rose twigs".

Epicymatia Balani Wint. Rea & Hawley **71** (XXXI, Part 13, p. 7 and 10, 1912). On casts of *Balanus*, with algae, Clare Island. Thought to be near *Pharcidia marina* Bomm. (see **28**, III, 98).

— **thallina** (Cooke) Sacc. in *Syll.* I, 572; *Sphaerella* Cooke in **14** (VIII, 10, 1879); Massee **14** (XIX, 44). On *Physcia*, Eastbourne. Keissler **119**, 355 makes this a synonym of *Pharcidia dispersa* (Lahm) Wint.

— **thallophila** (Cooke) Sacc. in *Syll.* I, 572; Wheldon **40** (1911, 38); *Sphaeria* Cooke in **15**, 872, 1871; *Psilosphaeria* Stevenson in **13**, 388; *Sphaerella* Cooke in **14** (XVIII, 79); Massee **14** (XIX, 44). On lichens, Scotland.

— **vulgaris** Fuckel. Massee **14** (XIX, 44) as *Sphaerella*; B. & Br. **19**, No. 871, 1859 as *Sphaeria apotheciorum* Massal.; Cooke **15**, 872; Plowr. Exs. III, No. 51. On *Lecanora*, Norfolk. Keissler **119**, 373 used the name *Pharcidia epicymatia* (Wallr. ap. Fr.) Wint.

Herpotrichia Keithii (Berk. & Br.) Sacc. in *Syll.* II, 212; *Sphaeria* B. & Br. in **19**, No. 1626*, 1876; *Byssosphaeria* Cooke in **14** (VII, 84); *Psilosphaeria* Cooke in **14** (VII, 84); *Psilosphaeria* Cooke in **14** (XVI, 51); Massee **14** (XVI, 117); *Lasiosphaeria* Berl. in **98** (I, 114*). On cordage, Dublin.

Herpotrichia macrotricha (Berk. & Br.) Sacc. in *Syll.* II, 213; *Sphaeria* B. & Br. in **19**, No. 619*, 1852; Cooke **15**, 859; *Lasiosphaeria* Cooke in **14** (XVI, 16 and 37). On *Carex*, Spye Park. Berlese **98** (I, 106) thought this might be *H. nigra*, but Petrak **105** (1925, 214) doubted it.

— **nigra** Hartig. Crossland **35** (June, 1905); **31** (July 1, 1905); **7**, 369; Massee **23** (XII, 177, 1905); **64** (XIX, 360, 1906); **89**, 223; **28** (II, 127). On conifers. See M. Ward **56** (XIV, 133, 1892).

— **pinetorum** (Fuckel) Wint. Recorded **28** (VII, 8) on *Ulex*; see Appendix I. Petrak **105** (1925, 214) cited the name as a synonym of *H. nigra*. See *Lasiosphaeria scabra*.

Hypospila bifrons (DC. ex Fr.) Sacc. Massee **14** (XV, 37); **7**, 220; Berk. **20**, 258, 1836 as *Sphaeria*; Currey **45** (XXII, 285*); *S. circumvoluta* Sowerby in **42**, t. 373, 1802; Cooke **15**, 930* as *Hypospila quercina*; Cooke Exs. 177 and II, No. 299. On leaves of *Quercus*.

— **immunda** (Fuckel) Sacc. Massee **14** (XV, 37); *Isothea* Cooke in **15**, 931, 1871. On leaves of *Quercus*, Shere.

— **pustula** (Pers. ex Fr.) Karst. Berk. **20**, 284, 1836 as *Phoma*; Berk. Exs. 40; *Isothea* Berk. in **18**, 392, 1860; Cooke **15**, 931; Bucknall **46** (II, 350); Cooke Exs. 499 and II, No. 298; Plowr. Exs. I, No. 79. On leaves of *Quercus*. This is the type species of *Phoma* Fries; but see **28** (XXIII, 289).

Lasiosphaeria ambigua Sacc. Massee **14** (XVI, 37, 1887). On burnt ground, Shrewsbury. This is doubtless var. *carbonaria* Rehm. Chenantais **117** (XXXV, 79) transferred this to *Lasiosordaria*. See Seaver **100** (IV, 115) for *Lasiosphaeria*, and *Leptospora* below.

— **biformis** (Pers. ex Fr.) Sacc. Massee **14** (XVI, 37); Berk. **20**, 261, 1836 as *Sphaeria*; Cooke **15**, 855. On old wood.

— **biformis** var. **terrestris** (Sowerby ex Fr.) Sacc. in *Syll.* II, 204; *Sphaeria terrestris* Sow. in **42**, t. 373, 1802; Berk. **20**, 261 as *S. biformis* var.; Cooke **15**, 855. On soil. Seaver **100** (IV, 120) cites it as *Lasiosphaeria terrestris* (Sow.) Thüm.

— **calva** (Tode ex Fr.) Stevenson in **13**, 390, 1879; Berk. **20**, 262, 1836 as *Sphaeria*; Cooke **15**, 858. On wood.

— **canescens** (Pers. ex Fr.) Karst. Stevenson **13**, 390; Massee **14** (XVI, 37); Berk. **20**, 261, 1836 as *Sphaeria*; Currey **45** (XXII, 315*); Cooke **15**, 858; Berk. Exs. 301; Plowr. Exs. I, No. 65; Cooke Exs. 590. On wood. See *L. strigosa*.

— **felina** (Fuckel) Cooke & Plowr. in **14** (VII, 85, 1879); Massee **14** (XVI, 36); B. & Br. **19**, No. 1332*, 1871 as *Sphaeria*; Cooke **14** (I, 156); Bucknall **46** (III, 26). On *Rubus*.

— **helicoma** (Phill. & Plowr.) Cooke & Plowr. in **14** (VII, 85, 1879); Sacc. II, 192; Berl. **98** (I, 112*); Massee **14** (XVI, 37); *Sphaeria* Phill. & Plowr. in **14** (VI, 26*, 1877); Plowr. Exs. III, No. 52. "On the ground where sawdust had lain."

— **hirsuta** (Fr.) Ces. & de Not. Massee **14** (XVI, 37); **7**, 227; Hooker 92, 7, 1821 as *Sphaeria*; Berk. **20**, 262; Currey **45** (XXII, 316*); Cooke **15**, 856, with var. *acinosa*; Plowr. Exs. II, No. 52 and 52A. On wood. Kirschstein, 1911 and Seaver **100** (1912, 119) consider *L. hirsuta*, *L. hispida* and *L. rhacodium* synonymous.

— **hispida** (Tode ex Fr.) Fuckel. Massee **14** (XVI, 37); **7**, 227; Berk. **20**, 262, 1836 as *Sphaeria*; Cooke **15**, 357; *S. ligniaria* Greville in **39**, t. 82, 1824; Currey **45** (XXII, 322*). On wood. See *L. hirsuta*.

— **mutabilis** (Pers. ex Fr.) Fuckel. Massee **14** (XVI, 37); **7**, 228; Currey **45** (XXII, 316*, 1859) as *Sphaeria*; Cooke **15**, 859. On wood. Seaver **100** (IV, 118) considers this to belong to the next species.

— **ovina** (Pers. ex Fr.) Ces. & de Not. Massee **14** (XVI, 36); **7**, 227; Berk. **20**, 260, 1836 as *Sphaeria*; Currey **45** (XXII, 316*); Cooke **15**, 856; Cooke Exs. II, Nos. 565, 576; Vize Exs. 289; Plowr. Exs. II, No. 51; *S. nivea* Sowerby in **42**, t. 219, 1799. On wood. See Seaver **100** (IV, 118).

Lasiosphaeria paucipilis (Cooke) Sacc. in *Syll.* II, 196; *Sphaeria* Cooke in **15,** 863, 1871. On wood.

— **rhacodium** (Pers. ex Fr.) Ces. & de. Not. Massee **14** (XVI, 37); **35** (Sept. 1881); **7,** 227; Berk. **20,** 261, 1836 as *Sphaeria*; Currey **45** (XXII, 315*); Berk. Exs. 283. On wood. See *L. hirsuta.*

— **scabra** (Currey) Auersw. in Rabenh. *Fungi Europ.* No. 1245; Sacc. II, 202; Bucknall **46** (V, 132, 1887); **14** (XVI, 37); *Sphaeria* Currey in **45** (XXII, 315*, 1859); Cooke **15,** 859. On *Ulex.* Berlese **98** (I, 115) referred this to *Herpotrichia pinetorum.*

— **spermoides** (Hoffm. ex Fr.) Ces. & de Not. Hooker **92,** 7, 1821 as *Sphaeria*; Greville **39,** t. 6, 1823; Berk. **20,** 265; Currey **45** (XXII, 318*); Cooke **15,** 861; Vize Exs. 102; Plowr. Exs. I, No. 66; *Psilosphaeria* Stevenson in **13,** 386; **14** (XVI, 117); **7,** 228. On wood. See Seaver **100** (IV, 121).

— **strigosa** (Alb. & Schw. ex Fr.) Sacc. Massee **14** (XVI, 37); Berk. **20,** 261, 1836 as *Sphaeria*; Cooke **15,** 858. On wood. Currey **45** (XXII, 316) and Seaver **100** (IV, 118) considered *L. canescens* probably the same species.

— **sulphurella** Sacc. Cooke **14** (XV, 43, 1886); **14** (XVI, 37); Hawley **28** (VIII, 227). On wood. See **117** (XXXV, 78 and 80, 1919).

[**Leptospora** has been used in Foray records for three species of *Lasiosphaeria,* but the type species of *Leptospora* Rabenh. in **105** (I, 116, 1857) is *L. porphyrogona. Leptospora* is therefore a synonym of the earlier genus *Ophiobolus.*]

Lulworthia fucicola Sutherland gen.nov. in **28** (V, 259*, 1916); Sacc. XXIV, 1059. On *Fucus,* Dorset.

Massarina Alni (Otth.) Sacc. Grove **27** (LXXI, 283*, 1933); Rhodes **108** (1933, 48). On *Alnus,* Wales and Worcs.

— **eburnea** (Tul.) Sacc. Cooke **27** (IV, 101*, 1866) as *Massaria*; **15,** 847*; Bucknall **46** (IV, 202, 1885); **14** (XVIII, 10); Cooke Exs. 371. On *Fagus.*

— **Tiliae** (Phill. & Plowr.) Sacc. in *Syll.* II, 154; *Massaria* Phill. & Plowr. in **14** (**X,** 72*, 1881, the fig. on pl. 58, vol. XI); Stevenson **40** (VII, 114); Massee **14** (XVIII, 10). On *Tilia,* Scotland. Berlese **98** (I, 120) considered the type specimen to be *Massariella Curreyi.*

Melomastia mastoidea (Fr.) Schroet. Berk. **19,** No. 183, 1841 as *Sphaeria*; Cooke **15,** 871; *Conisphaeria* Stevenson in **13,** 398; *Sphaeria Lonicerae* Sowerby in **42,** t. 293, 1803; Berk. **20,** 271; Currey **45** (XXII, 329*); Cooke **15,** 874; Cooke Exs. 262; Plowr. Exs. I, No. 77; *Psilosphaeria Lonicerae* Stevenson in **13,** 388; *Sphaeria revelata* B. & Br. in **19,** No. 634*, 1852; Cooke **15,** 887; **14** (VIII, 108); **105** (XIV, 25); *S. fraxinicola* Currey in **45** (XXIV, 128*, 1863); B. & Br. **19,** No. 1098; Cooke **15,** 881; *Conisphaeria Friesii* (Nits.) Cooke in **14** (XVI, 87); Massee **14** (XVII, 4). On *Lonicera, Fraxinus,* etc. This fungus is often called *Melomastia Friesii* Nits.

Metasphaeria acorella (Cooke) Berl. & Vogl. in Sacc. *Addit. I–IV,* 158; Massee **14** (XVIII, 41); Grove **27** (LXVIII, 97); *Leptosphaeria* Cooke in **14** (XIII, 99, 1885). On *Acorus.*

— **anarithma** (Berk. & Br.) Sacc. in *Syll.* II, 175; Grove **27** (LXVIII, 99); Massee **14** (XVIII, 41); Rhodes **108** (1933, 48); *Sphaeria* B. & Br. in **19,** No. 893*, 1859; *Sphaerella* Cooke in **27** (IV, 251*, 1866); **15,** 920; **14** (XIX, 43). On *Aira.* Berlese **98** (I, 135) found the type specimen sterile.

— **Ashwelliana** (Currey) Sacc. in *Syll.* II, 167; *Sphaeria* Currey in **45** (XXII, 327*, 1859); Cooke **15,** 889; *Endophlaea* Cooke in **14** (XVII, 89); **14** (XVIII, 11). On "fir", Surrey.

— **cetrariicola** (Nyl. ex Cooke) Sacc. in *Syll.* II, 184; Massee **14** (XVIII, 41); *Sphaeria* Nyl. ex Cooke in **14** (III, 68, 1874); *Psilosphaeria* Cooke in **14** (VII, 85); Stevenson **13,** 389. On *Cetraria,* Scotland. Keissler **119,** 273 transfers this to *Phragmothyrium.*

— **complanata** (Tode ex Fr.) Sacc. Massee **14** (XVIII, 41); **7,** 234; Berk. **20,** 275, 1836 as *Sphaeria*; B. & Br. **19,** No. 644; Cooke **15,** 903; Currey **68** A (III, 269*, 1855). On stems.

Metasphaeria conformis (Berk. & Br.) Sacc. in *Atti Istit. Veneto*, p. 935, 1884; Sacc. *Addit. I–IV*, 155; *Sphaeria* B. & Br. in **19**, No. 635*, 1852; Currey **45** (XXII, 325*, 1859); Cooke Exs. 265; Cooke **15**, 888 as *S. ditopa* f. *octospora*; see Tul. **114** (II, 145); Berlese **98** (I, 147) considered *S. conformis* a form of *Leptosphaeria doliolum*. On *Alnus*.

— **corticola** (Fuckel) Sacc. Grove **1** (II, 329); Bucknall **46** (IV, 203, 1885 as *Sphaeria*, on *Prunus*, fig. in V, pl. VIII); Brooks & Alaily **34** (XXXVI, 213*) as *Griphosphaeria*. On *Rosa*. See **102** (1918, 87; 1921, 32).

— **culmifida** (Karst.) Sacc. Grove **27** (L, 49, 1912); Bucknall **46** (V, 128* and 132, 1887) as *Sphaeria*. On grass.

— **cumana** (Sacc. & Speg.) Sacc. Massee **14** (XVIII, 41); Grove **27** (LXVIII, 98*); Bucknall **46** (IV, 203, 1885) as *Sphaeria*. On *Carex*.

— **dealbata** (Cooke) Berl. in **98** (I, 133*, 1893); *Xylosphaeria* Cooke in **14** (XV, 100, 1887); *Zignoella* Sacc. in *Syll.* IX, 867. On branches, Sussex.

— **Empetri** (Fr. p.p. ?) Sacc. *Sphaerulina* Cooke in **14** (XVIII, 79); Massee **14** (XIX, 44, 1890). On *Empetrum*. Massee perhaps gave this record in error for *Didymosphaeria Empetri*.

— **Hederae** (Sowerby ex Fr.) Sacc. in *Syll.* II, 169; *Sphaeria* Sowerby in **42**, t. 371, 1802; Berk. **20**, 278; *Sphaerella* Cooke in **15**, 921; **46** (II, 218); *Sphaerulina* Cooke in **14** (XVIII, 79); **14** (XIX, 44); **7**, 237. On *Hedera*.

— **helicicola** (Desm.) Sacc. *Sphaerulina* Cooke in **14** (XVIII, 90); Massee **14** (XIX, 44, 1890). On *Hedera*, Carlisle.

— **ocellata** (Niessl) Sacc. Grove **27** (1932, 6). On *Hypericum*, Pembroke. Grove previously **27** (1930, 98) placed this as a synonym of *Clypeosphaeria Hyperici*.

— **persistens** (Berk. & Br.) Sacc. in *Syll.* II, 163; *Sphaeria* B. & Br. in **19**, No. 637*, 1852; Cooke **15**, 888; *Endophlaea* Cooke in **14** (XVII, 89); Massee **14** (XVIII, 11). Berlese **98** (I, 146) found the type specimen sterile, but thought it a *Diaporthe*. On *Rosa*, King's Cliffe.

— **recutita** (Fr.) Sacc. Massee **14** (XVIII, 41); Berk. **20**, 278, 1836 as *Sphaeria*; *Sphaerella* Cooke in **27** (IV, 252, 1866); **15**, 921, with note that the figure in **27** (IV) represents another fungus. On grass.

— **rubida** Bloxam ex Cooke in **14** (XX, 83, 1892); Sacc. XI, 335. On stems, Twycross.

— **rustica** (Karst.) Sacc. Grove **27** (LXXI, 285*, 1933). On *Spiraea*, Oscott College.

— **sabuletorum** (Berk. & Br.) Sacc. in *Syll.* II, 180; Massee **14** (XVIII, 41); *Sphaeria* B. & Br. in **19**, No. 650*, 1852; Cooke **15**, 905; Plowr. Exs. I, No. 91. On *Ammophila*.

— **sepincola** Berl. in **98** (I, 132), with the incorrect author citation "(B. & Br.) Sacc. p.p."; B. & Br. **19**, No. 636, 1852 in error as *Sphaeria sepincola* Fr. On *Cornus*. Transferred to *Sclerodothis* by Petrak in **102** (1921, 41). This fungus has been confused with *Saccothecium sepincola* (q.v.), to which some of the following records refer: Rhodes **108** (1933, 48); Cooke **15**, 888 as *Sphaeria*; Cooke Exs. 263; *Endophlaea* Cooke in **14** (XVII, 89); Massee **14** (XVIII, 11).

— **Thwaitesii** (Berk. & Br.) Sacc. in *Syll.* II, 161; Berl. **98** (I, 130*); Massee **14** (XVIII, 41); *Sphaeria* B. & Br. in **19**, No. 646*, 1852; Cooke **15**, 906. On stems.

— **tritorulosa** (Berk. & Br.) Sacc. in *Syll.* II, 157 (as "*bitorulosa*"); Massee **14** (XVIII, 41); *Sphaeria* B. & Br. in **19**, No. 778*, 1854; Cooke **15**, 905. On *Epilobium*.

Saccothecium sepincola (Fr.) Fr. Kirschstein, *Krypt. Fl. Mark Brand.* VII, 425, 1938; Berk. **20**, 271, 1836 as *Sphaeria*. On *Cornus*. Von Hohnel **102** (1920, 97) transferred this to *Pringsheimia*, and Petrak **102** (1921, 37) agreed. Kirschstein revived *Saccothecium* Fr., mentioned by Berkeley in 1836. See *Metasphaeria sepincola* above.

Sphaerulina Alni A. L. Smith in **28** (VI, 151, 19.8); Sacc. XXIV, 948. On *Alnus*, Scotland.

[**Sphaerulina intermixta** (Berk. & Br.) Sacc. in *Fungi Ital.* t. 347; *Syll.* II, 187; Grove **27** (LVII, 208, 1919); Rhodes **108** (1933, 48); *Sphaeria* B. & Br. in **19**, No. 639*, 1852; Cooke **15**, 889. On *Rosa*. See *Leptosphaeria abbreviata*. *Sphaeria intermixta* is placed by most modern authors as a synonym of *Sphaeria sepincola* Fr.]

— **intermixta** var. **abbreviata** Grove in **27** (XXIII, 161, 1885). On *Rubus*. (See *Leptosphaeria abbreviata*.). "Var. *Corni*" is mentioned by Bucknall **46** (V, 53, 1886).

— **intermixta** forma **valde-evoluta** Grove in **27** (LVII, 210*, 1919), on *Rosa*; Rhodes **108** (1933, 48), on *Rubus*.

— **Leightoni** (Berk. & Br.) Sacc. in *Syll.* II, 188; Massee **14** (XIX, 44); *Sphaeria* B. & Br. in **19**, No. 659*, 1852; *Sphaerella* Cooke in **27** (IV, 250*, 1866); **15**, 918. On *Linnaea*.

— **myriadea** (DC. ex Fr.) Sacc. Massee **14** (XIX, 44); *Sphaerella* Cooke in **27** (IV, 247*, 1866); **15**, 915; Vize Exs. 195; Cooke Exs. 172. On leaves of *Quercus*.

[— **Rehmiana** Jaap. The conidia only, *Septoria Rosae* Desm., known in Britain.]

— **Taxi** (Cooke) Massee in **5**, 220*, 1910; Sacc. XXII, 191; **94** (V, 93); **65** (XXX, 349); Callen **28** (XXII, 94*, with synonymy and references); *Sphaerella* Cooke in **31** (1878, 274); **14** (VI, 128); Sacc. I, 480; B. & Br. **19**, No. 2050, 1885; Cooke Exs. II, No. 697; Plowr. Exs. III, No. 90; Vize Exs. 600; Stevenson **13**, 404, 1879 as "*Sphaeria Taxi* Sow. ... *Sphaeropsis* C. Hbk. No. 1252". On leaves of *Taxus*.

— **Trifolii** Rostrup. Kathleen Sampson **26**A (I, 15, 1922). On *Trifolium repens*, Wales.

Stuartella Carlylei Cooke & Massee in **14** (XIX, 86, 1891); Sacc. IX, 815. On wood, Carlisle, coll. Carlyle.

Zignoella collabens (Currey) Sacc. in *Syll.* II, 221; Berl. **98** (I, 100*); **28** (IV, 68); *Sphaeria* Currey in **45** (XXII, 320*, 1859); Cooke **15**, 864, with *S. Curreyi* Bloxam ex Currey (loc. cit.) as variety; *Psilosphaeria collabens* Stevenson in **13**, 386; Massee **14** (XVI, 117). On wood.

— **eutypoides** Sacc. Wheldon **28** (VI, 85); **115**, 35. On *Corylus*, Selby foray, 1918.

— **fallax** (Sacc.) Sacc. Grove **27** (LXXI, 284, 1933). On wood, Cheshire.

— **hysterioides** (Currey ex Cooke) Sacc. in *Syll.* IX, 866; *Conisphaeria* Currey ex Cooke in **14** (XVI, 92, 1888); Massee **14** (XVII, 4). On wood.

— **macrasca** Sacc. *Conisphaeria* Cooke in **14** (XVI, 88); Massee **14** (XVII, 4, 1888); **7**, 231. On wood.

— **poecilostoma** (Berk. & Br.) Sacc. in *Syll.* II, 220; *Sphaeria* B. & Br. in **19**, No. 876*, 1859; Cooke **15**, 870; Vize Exs. 174; Cooke Exs. 452 and II, No. 248; *Conisphaeria* Stevenson in **13**, 397; Massee **14** (XVII, 4); **46** (V, 132). On *Ulex*. Berlese **98** (I, 101) considered this to be *Lophiotrema praemorsum*.

— **pulviscula** (Currey) Sacc. in *Fungi Ital.* t. 297; *Syll.* II, 214; *Sphaeria* Currey in **45** (XXII, 320*, 1859); Cooke **15**, 864; *Psilosphaeria* Stevenson in **13**, 387, 1879; Massee **14** (XVI, 117); Bucknall **46** (V, 52); **7**, 229 as *Melanomma*. On wood. Berlese **98** (I, 98*) considered *Z. ovoidea* (Fr.) Sacc. an earlier name; see also **102** (XIV, 430; XVIII, 79).

— **rhodobapha** (Berk. & Br.) Sacc. in *Mich.* I, 347; *Syll.* II, 221; Berl. **98** (I, 95*); *Sphaeria* B. & Br. in **19**, No. 1334*, 1871; Bucknall **46** (III, 269); *Conisphaeria* Cooke in **14** (XVI, 87); Massee **14** (XVII, 4). On wood.

— **rhytidodes** (Berk. & Br.) Sacc. in *Mich.* I, 346; *Syll.* II, 217; *Sphaeria* B. & Br. in **19**, No. 873*, 1859; Cooke **15**, 862; *Psilosphaeria* Cooke in **14** (XVI, 61); **14** (XVI, 117). On *Fraxinus*. Berlese **98** (I, 101) thought it a *Melanomma*.

— **seriata** (Currey) Sacc. in *Syll.* II, 219; Berl. **98** (I, 95*); *Sphaeria* Currey in **45** (XXII, 329*, 1859); *Psilosphaeria* Cooke in **14** (XVI, 50); **14** (XVI, 117); *Sphaeria pusilla* Currey apud Berk. in **18**, 399, 1860; Cooke **15**, 889. On wood.

SPHAERIACEAE: PHAEOPHRAGMIAE

Aglaospora profusa (Fr.) de Not. Tul. **114** (II, 159); Berk. **20**, 249, 1836 as *Sphaeria*; Currey **45** (XXII, 277*); Berk. **18**, 389 as *Valsa*; Cooke **15**, 838; *Pseudovalsa* Cooke in **14** (XIV, 55); **14** (XV, 120). On *Robinia*, Blackheath Park. Petrak **102** (1923, 114) and **105** (1925, 222) calls this *Massaria anomia* (Fr.) Petrak.

Caryospora callicarpa (Currey) Nits. in Fuckel, *Symb. Myc.*; Sacc. II, 123; *Sphaeria* Currey in **45** (XXII, 321*, 1859); Cooke **15**, 870; *Amphisphaeria* Cooke in **14** (XVI, 90); **14** (XVII, 5). On wood, Kidbroke.

Chaetomastia canescens (Speg.) Berl. Wheldon **27** (LI, 189, 1912). On "fir posts", Lancs.

Chaetosphaeria callimorpha (Mont.) Sacc. B. & Br. **19**, No. 872, 1859 as *Sphaeria*; Cooke **15**, 859; *Lasiosphaeria* Stevenson in **13**, 391; *Byssosphaeria* Cooke in **14** (XV, 123); **14** (XVI, 36); **7**, 227; Plowr. Exs. II, No. 53 as *Sphaeria ruborum*. On *Rosa*.

— **cupulifera** (Berk. & Br.) Sacc. in *Syll.* II, 94; Massee **14** (XVI, 36); *Sphaeria* B. & Br. in **19**, No. 1333*, 1871; Bucknall **46** (II, 349); *Lasiosphaeria* Cooke & Plowr. in **14** (VII, 85). On *Ulmus*.

— **innumera** (Berk. & Br.) Tul. gen.nov. in **114** (II, 252*, 1863); Sacc. II, 95; B. & Br. **19**, No. 1728; Berl. **98** (I, 27*); *Sphaeria* B. & Br. apud Berk. in **18**, 395, 1860; Cooke **15**, 861; Plowr. Exs. II, No. 54; *Byssosphaeria* Cooke in **14** (XV, 123); **14** (XVI, 36); **7**, 227; *Lasiosphaeria* Stevenson in **13**, 391, 1879; Bucknall **46** (IV, 60). On wood.

— **phaeostroma** (Dur. & Mont.) Fuckel. B. & Br. **19**, No. 605, 1851 as *Sphaeria*; Currey **45** (XXII, 315*); Cooke **15**, 854; Cooke Exs. 454; Vize Exs. 171; Plowr. Exs. I, No. 62; *Byssosphaeria* Stevenson in **13**, 386; Massee **14** (XVI, 36); **7**, 227; *Sphaeria tristis* var. β Berk. in **20**, 260, 1836. On wood. Like *Calyculosphaeria tristis*, with which Berkeley at first confused it, always associated with species of Diatrypaceae.

— **pileoferruginea** Crouan. Massee **14** (XVI, 36, 1887); Cooke **14** (XVI, 47). On *Calluna*, Carlisle.

Clypeosphaeria Hyperici (Phill. & Plowr.) Sacc. in *Syll.* II, 92; *Sphaeria* Phill. & Plowr. in **14** (VIII, 108*, 1880); *Heptameria* Cooke in **14** (XVIII, 31); Massee **14** (XVIII, 60); *Metasphaeria* Grove in **27** (LXVIII, 98). On *Hypericum*. See *Metasphaeria ocellata*.

— **mamillana** (Fr.) Lambotte. Cooke **14** (I, 175, 1873) as *Sphaeria*; Plowr. Exs. III, No. 58; *Leptosphaeria* Cooke in **14** (XVII, 91); Massee **14** (XVIII, 12). On *Quercus*. See **105** (1925, 200) and next entry.

— **Notarisii** Fuckel. Massee **37** (1913, 197); *Leptosphaeria* Cooke in **14** (XVII, 91); Massee **14** (XVIII, 12); Berk. **20**, 270, 1836 as *Sphaeria clypeata* Nees; B. & Br. **19**, No. 888, 1859; Cooke **15**, 889; Bucknall **46** (III, 139); Plowr. Exs. I, No. 85 and III, No. 51. On *Rubus* and *Epilobium*. Rehm **102** (1909, 410) considered this a form of the preceding. See *Trematosphaeria melina*, *Leptosphaeria Tamaricis*, and next two entries.

Kalmusia hemitapha (Berk. & Br.) Sacc. in *Syll.* II, 143; *Sphaeria* B. & Br. in **19**, No. 885*, 1859; Cooke **15**, 878; *Xylosphaeria* Bucknall in **46** (III, 138); Massee **14** (XV, 9). On *Quercus*. Berlese **98** (I, 45) considered this and the next to be *Clypeosphaeria Notarisii*, but Traverso in *Flora Italica* does not accept all Berlese's determinations of *C. Notarisii*.

— **hypotephra** (Berk. & Br.) Sacc. in *Syll.* II, 144; *Sphaeria* B. & Br. in **19**, No. 624*, 1852; Cooke **15**, 878; Plowr. Exs. II, No. 62; *Xylosphaeria* Stevenson in **13**, 398; Massee **14** (XVIII, 9); Plowr. Exs. I, No. 54 issued as "*Cucurbitaria elongata* var. *simplex*", corrected to *Sphaeria hypotephra* in Cent. III. On *Quercus* and *Fagus*.

— **stromatica** Cooke & Massee in **14** (XX, 8, 1891); Sacc. XI, 331. On branches, Oxford.

Kalmusia surrecta (Cooke) Sacc. in *Syll.* II, 144; *Sphaeria* Cooke in **14** (v, 119, 1877); *Xylosphaeria* Cooke in **14** (VII, 86). On wood of *Pinus*, Surrey. Berlese **98** (I, 34*) considered this a *Melanomma*.

Leptosphaeria abbreviata (Cooke) Sacc. in *Syll.* II, 26; Massee **14** (XVIII, 12); *Sphaeria* Cooke in **27** (IV, 102, 1866); **15**, 893. On *Rubus*. Berlese **98** (I, 87) thought the type to be *Sphaerulina intermixta*, and Grove **27** (LVII, 209) reached the same conclusion by assuming that Cooke had mistakenly called the spores brown. Petrak **102** (1921, 38) suggested *L. Coniothyrium* from the description.

— **acuta** (Hoffm. ex Fr.) Karst. Hodgetts **32** (XVI, 139; XXXII, 178, spore discharge); Cooke **15**, 901 as *Sphaeria*; Cooke Exs. 265 and II, No. 254; Plowr. Exs. I, No. 89; Vize Exs. 187; *Heptameria* Cooke in **14** (XVIII, 31); Massee **14** (XVIII, 58); Greville **39**, t. 239, 1826 as *Sphaeria coniformis* Fr.; Berk. **19**, No. 190, 1841; Currey **45** (XXII, 330*). Common on stems of *Urtica*.

— **agnita** (Desm.) Ces. & de Not. Cooke **15**, 903, 1871 as *Sphaeria*; Bucknall **46** (III, 69); Cooke Exs. 277 and II, No. 255; Plowr. Exs. II, No. 80; *Heptameria* Cooke in **14** (XVIII, 31); Massee **14** (XVIII, 58). On *Eupatorium*.

— **Aparines** (Fuckel) Sacc. "*Sphaeria aparinae* Fuckel" [n. comb.] Phill. & Plowr. in **14** (VI, 27, 1877); Plowr. Exs. III, No. 82; *Heptameria* Cooke in **14** (XVIII, 30); Massee **14** (XVIII, 58). On *Galium Aparine*, Norfolk. Berlese **98** (I, 68*) figured Cooke Exs. II, No. 690.

— **arundinacea** (Sowerby ex Fr.) Sacc. in *Fungi Ven.* Ser. II, 320; *Syll.* II, 62; *Sphaeria* Sowerby in **42**, t. 336, 1801; Berk. **20**, 256; B. &. Br. **19**, No. 603, 1851; Currey **45** (XXII, 285*); Cooke **15**, 875; Berk. Exs. 82; Plowr. Exs. II, No. 61; Cooke Exs. 675; *Heptameria* Cooke in **14** (XVIII, 32); Massee **14** (XVIII, 59). On *Phragmites*. Grove **1** (I, 117) placed *Sphaeria arundinacea* Sowerby under *Phoma*. Berlese **98** (I, 69*) figured a specimen from Plowright, Thüm. in Myc. Univ. No. 1256.

— **arundinacea** var. **Godini** (Desm.) Sacc. Bucknall **46** (V, 53, 1886); Currey **45** (XXII, 285*, 1858) as *Sphaeria Godini* Desm. On grasses.

— **caninae** (Phill. & Plowr.) Sacc. in *Syll.* II, 81; *Sphaeria* Phill. & Plowr. in **14** (VI, 27*, 1877); *Psilosphaeria* Cooke & Plowr. in **14** (VII, 84, 1879); *Heptameria* Cooke in **14** (XVIII, 31); Massee **14** (XVIII, 60). On *Peltigera canina*, Dunsley. Transferred to *Phaeospora* by Vouaux in **117** (1913, 74).

— **Chondri** (Rostr.) Rosenv. Cotton **28** (III, 93, 1909). On *Chondrus crispus*, Dorset. Lind (*Danish Fungi*, p. 214) uses the name *Didymosphaeria marina* (Rostr.) Lind.

— **circinans** (Fuckel) Sacc. Massee **27** (XLVI, 151, 1908). On *Medicago*, Kent. *Rhizoctonia violacea* [*R. Crocorum* (Pers.) DC. ex Fr.] was erroneously thought by some continental authors to be a stage of this species.

— **clara** (Auersw. ex Cooke) Sacc. in *Syll.* II, 73; *Sphaeria* Auersw. ex Cooke in **14** (v, 121, 1877); *Heptameria* Cooke in **14** (XVIII, 32); Massee **14** (XVIII, 59). On *Festuca*.

— **clivensis** (Berk. & Br.) Sacc. in *Syll.* II, 16; Berl. **98** (I, 63*); Grove **27** (LX, 173); *Sphaeria* B. & Br. in **19**, No. 643*, 1852; Currey **45** (XXII, 331*, 1859); Cooke **15**, 897; Cooke Exs. 386; Plowr. Exs. III, No. 60; *Heptameria* Cooke in **14** (XVIII, 30); Massee **14** (XVIII, 58). On stems. See *L. Galiorum*.

— **Coniothyrium** (Fuckel) Sacc. Reported **65** (XXX, 340); **77** (1928–30, II, 135; 1931, 48); **79** (I, 30); **22** (Bull. 79, p. 83 and 98, 1934, ascospores found); **71** (XL, 49, 1931, Ireland). On *Rubus*.

— **conoidea** (de Not.) Sacc. *Heptameria* Cooke in **14** (XVIII, 29); Massee **14** (XVIII, 57); Cooke **15**, 902, 1871 as *Sphaeria doliolum* var. *conoidea*. On herbs, Surrey. *S. Helenae* Currey in **45** (XXII, 331*, 1859) is placed here by Cooke.

— **Cookei** Pirotta. Sacc. II, 28; Massee **14** (XVIII, 12); **7**, 234; Cooke Exs. 618 and II, No. 14, p.p., as *Phoma Vitis*. On *Vitis*, Terrington.

— **cruenta** Sacc. Grove **27** (XXIII, 161, 1885). On *Carduus*, Staffs. Grove later **27** (LXVIII, 97) thought it might be the same as *L. purpurea* Rehm.

Leptosphaeria culmicola (Fr.) Karst. Bucknall **46** (v, 128* and 132, 1887) as *Sphaeria*; *Heptameria* Cooke in **14** (xviii, 32); Massee **14** (xviii, 59). On grasses. See Grove **27** (1922, 173).

— **culmifraga** (Fr.) Ces. & de Not. Berk. **20**, 275, 1836 as *Sphaeria*; B. & Br. **19**, No. 614, 1851; Cooke **15**, 875; Vize Exs. 191; Cooke Exs. 676; *Heptameria* Cooke in **14** (xviii, 32); Massee **14** (xviii, 59); *S. longa* Sowerby in **42**, t. 393, 1803. On grasses.

— **densa** Bres. Grove **27** (lxxi, 280, 1933). On *Acorus*, Worcs.

— **derasa** (Berk. & Br.) Thüm. in Myc. Univ. No. 269; Sacc. ii, 41; Berl. **98** (i, 82*); Hawley **28** (ix, 239); *Sphaeria* B. & Br. in **19**, No. 639*, 1852; Cooke **15**, 904; Plowr. Exs. i, No. 90; Vize Exs. 179; Cooke Exs. 491 and ii, No. 249; *Heptameria* Cooke in **14** (xviii, 31); Massee **14** (xviii, 58). On *Senecio*.

— **dioica** (Fr.) Sacc. Berk. **20**, 253, 1836 as *Sphaeria*; Cooke **15**, 873; *Psilosphaeria* Stevenson in **13**, 388; Bucknall **46** (v, 132, 1882); *Cucurbitaria* Cooke in **14** (xv, 85); Massee **14** (xvi, 34). On *Acer*, etc. Berlese **98** (i, 87) considered British specimens to be *Thyridaria*.

— **dolioloides** (Auersw.) Karst. Grove **27** (lxviii, 73, *L. pellita* Sacc. considered a synonym); Rhodes **108** (1933, 48); Bucknall **46** (v, 128* and 132, 1887) as *Sphaeria* [n. comb. ?]. On herbs. Grove proposed f. *Tanaceti* and f. *Achilleae*, Worcs.

— **doliolum** (Pers. ex Fr.) de Not. Hawley **28** (ix, 239); Hooker **92**, 7, 1821 as *Sphaeria*; Berk. **20**, 275; Currey **45** (xxii, 329*; xxv, 259); Cooke **15**, 902; Berk. Exs. 290; Baxter Exs. 31; Vize Exs. 178; Cooke Exs. 489 and ii, No. 495; Plowr. Exs. ii, No. 79; *Heptameria* Cooke in **14** (xviii, 29); Massee **14** (xviii, 57); *Cryptosphaeria* Greville in **39**, t. 239, 1826. Common on stems.

— **dumetorum** Niessl. Recorded with doubt by Grove **27** (1932, 4) on *Serratula*, Worcs.

— **duplex** (Sowerby ex Fr.) Sacc. in *Syll.* ii, 87; *Sphaeria* Sowerby in **42**, t. 375, 1803; Berk. **20**, 277; Cooke **15**, 909; *Heptameria* Cooke in **14** (xviii, 31); Massee **14** (xviii, 59). On *Sparganium*.

— **echinella** (Cooke) Thum. in Myc. Univ. No. 266; Sacc. ii, 88; *Sphaeria* Cooke in **15**, 906, 1871; Plowr. Exs. iii, No. 62; Cooke Exs. 267 and ii, No. 256; *Heptameria* Cooke in **14** (xviii, 30); Massee **14** (xviii, 58). On *Atriplex*. Berlese **98** (ii, 33*) found Cooke Exs. ii, No. 256 to be a *Pyrenophora*.

— **epicalamia** (Riess) Ces. & de Not. Massee **14** (xviii, 59, 1890); Grove **27** (lxxi, 281); Rhodes **108** (1933, 48). On *Luzula*, etc.

— **epicarecta** (Cooke) Sacc. in *Syll.* ii, 65; *Sphaeria* Cooke in **14** (v, 120, 1877); *Heptameria* Cooke in **14** (xviii, 32); Massee **14** (xviii, 59). On *Carex*, Shere.

— **Fuckelii** Niessl apud Voss. Grove **27** (liv, 186*, 1916). On *Phalaris*, Warwicks.

— **fuscella** (Berk. & Br.) Ces. & de Not. in *Schema*, p. 236; Sacc. ii, 30; Berl. **98** (i, 65*); Massee **14** (xviii, 12); *Sphaeria* B. & Br. in **19**, No. 636*, 1852; Currey **45** (xxii, 327*); Cooke **15**, 892. On *Rosa*.

— **Galiorum** Sacc. Bucknall **46** (v, 128* and 132, 1887) as *Sphaeria* [n. comb.?]. On *Galium*, near Bristol.

— **Galiorum** f. **Dipsaci** Grove in **27** (lvi, 286*, 1918); Rhodes **108** (1933, 48). On *Dipsacus* near Droitwich. Grove later **27** (1922, 173) decided that all forms of *L. Galiorum* are *L. clivensis*.

— **gloeospora** (Berk. & Currey) Sacc. in *Syll.* ii, 25; *Sphaeria* Berk. & Currey in **19**, No. 980*, 1861; Cooke **14**, 898; *Heptameria* Cooke in **14** (xviii, 30); Massee **14** (xviii, 58). On *Artemisia*, Fleetwood. Berlese **98** (i, 87) found the type specimen too old for study.

— **graminis** (Fuckel) Sacc. *Heptameria* Cooke in **14** (xviii, 32); Massee **14** (xviii, 59); *Sphaeria* Phill. & Plowr. in **14** (viii, 108, 1880); Bucknall **46** (iii, 270); Plowr. Exs. iii, No. 83. On *Phragmites*.

— **haematites** (Rob.) Niessl. Rilstone **27** (1935, 102). On *Clematis*, Cornwall.

— **heterospora** (de Not.) Niessl. Pethybridge **22** (Bull. 79, p. 111, 1934). On *Iris*, Surrey.

Leptosphaeria juncina (Auersw.) Sacc. Cooke **14** (v, 121, 1877) as *Sphaerella*; Bucknall **46** (v, 54); Cooke Exs. II, No. 569; Plowr. Exs. III, No. 92; *Heptameria* Cooke in **14** (XVIII, 32); Massee **14** (XVIII, 59). On *Juncus*.

— **Lemaneae** (Cohn & Woron.) Sacc. Berl. **98** (I, 59*); Brierley, *Mem. Lit. Phil. Soc. Manchester* 57, No. 8, 1913; *Heptameria* Cooke in **14** (XVIII, 31, 1889); Massee **14** (XVIII, 60); *Sphaeria fluviatilis* Phill. & Plowr. in **14** (x, 73, 1881); **14** (XIII, 77); *Leptosphaeria fluviatilis* Sacc. in *Syll.* II, 84. On *Lemanea*.

— **littoralis** Sacc. Grove **27** (LXVIII, 73*, 1930). On *Ammophila*, Wales.

— **lucina** Sacc. Grove **27** (XXIII, 132, 1885). On *Cytisus*, Warwicks.

— **Lunariae** (Berk. & Br.) Sacc. in *Syll.* II, 57; von Höhnel *Frag. Myk.* No. 713; *Sphaeria* B. & Br. in **19**, No. 892*, 1859; Cooke **15**, 897; *Heptameria* Cooke in **14** (XVIII, 31); Massee **14** (XVIII, 58). On *Lunaria*. Berlese **98** (I, 56) transferred it to *L. eustoma* (Fr.) Sacc. as a form.

— **maculans** (Desm.) Ces. & de Not. B. & Br. **19**, No. 1727, 1878 as *Sphaeria*; Stevenson **13**, 404; *Heptameria* Cooke in **14** (XVIII, 30); Massee **14** (XVIII, 58); B. & Br. **19**, No. 1178, 1866 as *S. Alliariae* Auersw.; Cooke **27** (IV, 103*, 1866); **15**, 903; Plowr. Exs. II, No. 81; Rhodes **108** (1933, 48) as *L. Alliariae*. On Crucifers.

— **maritima** (Cooke & Plowr.) Sacc. in *Syll.* II, 73; Berl. **98** (I, 73*); *Sphaeria* Cooke & Plowr. in **14** (v, 120, 1877); Cooke Exs. II, No. 570; *Heptameria* Cooke in **14** (XVIII, 32); Massee **14** (XVIII, 59). On *Juncus*, N. Wootton.

— **marram** (Cooke) Sacc. in *Syll.* II, 60; Berl. **98** (I, 60*); *Sphaeria* Cooke in **14** (v, 120, 1877); Cooke Exs. II, No. 574; Bucknall **46** (IV, 150); *Heptameria* Cooke in **14** (XVIII, 31); Massee **14** (XVIII, 59). On *Ammophila*.

— **Michotii** (Westend.) Sacc. Bucknall **46** (v, 53*, 1886, on *Berberis*); **71** (XXI, 7; Ireland); Cooke **14** (v, 119, 1877) as *Sphaeria*; Cooke Exs. II, No. 573; Plowr. Exs. III, No. 67; *Heptameria* Cooke in **14** (XVIII, 31); Massee **14** (XVIII, 58). On sedges and grasses. Plowr. Exs. III, No. 68 was issued as "f. *graminis*".

— **microscopica** Karst. Bucknall **46** (v, 48* and 53, 1886); Grove **27** (1912, 49; 1916, 192); Hawley **28** (IX, 239); *Heptameria* Cooke in **14** (XVIII, 31); Massee **14** (XVIII, 58); O'Connor **70** (XXI, 398) as *L. culmorum* Auersw.; Rilstone **27** (1935, 102). On grasses.

— **modesta** (Desm.) Karst. O'Connor **70** (XXI, 398, 1936, Ireland); B. & Br. **19**, No. 644*, 1852 as *Sphaeria*; Cooke **15**, 905. On *Scrophularia*.

— **Nardi** (Fr.) Ces. & de Not. Berl. **98** (I, 75*); Cooke **14** (v, 120, 1877) as *Sphaeria*; Stevenson **13**, 405; Bucknall **46** (III, 139); Cooke Exs. II, No. 571; *Heptameria* Cooke in **14** (XVIII, 32); Massee **14** (XVIII, 59). On *Nardus*.

— **nectrioides** Speg. Bucknall **46** (v, 48* and 53, 1886). On *Clematis*, Bristol.

— **Niessleana** Rabenh. Listed by Rilstone **27** (1935, 102) on *Lathyrus*, Cornwall.

— **Niessleana** f. **Viciae** Grove in **27** (LXVIII, 74, 1930, thought perhaps to be *L. Endiusae* (Fuckel) Sacc.); Rhodes **108** (1933, 48). On *Vicia*.

— **nigrans** (Desm.) Ces. & de Not. B. & Br. **19**, No. 640*, 1852 as *Sphaeria*; Cooke **15**, 904; Bucknall **46** (III, 70); *Heptameria* Cooke in **14** (XVIII, 32); Massee **14** (XVIII, 59). On grass.

[— **nigrella** (Rabenh.) Sacc. *Heptameria* Cooke in **14** (XVIII, 30); Massee **14** (XVIII, 58). On *Angelica*. A mistaken compilation by Massee of *Didymella nigrella*.]

— **norfolcia** (Cooke) Sacc. in *Syll.* II, 73; Berl. **98** (I, 76*); *Sphaeria* Cooke in **14** (v, 120, 1877); *Heptameria* Cooke in **14** (XVIII, 32); Massee **14** (XVIII, 89). On *Eleocharis* and *Juncus*.

— **Obiones** (Crouan) Sacc. f. **evolutior** Grove in **27** (LXXI, 281*, 1933). On *Atriplex* (*Obione*), Cornwall.

— **octophragmia** Trav. & Frag. var. **major** Grove in **27** (LXXI, 282, 1933). On *Lippia citriodora* (cult.), Cornwall.

— **Ogilviensis** (Berk. & Br.) Ces. & de Not. in *Schema*, p. 61; Sacc. II, 34; *Sphaeria* B. & Br. in **19**, No. 642*, 1852; Cooke **15**, 905; Bucknall **46** (IV, 60); Vize Exs. 499; *Heptameria* Cooke in **14** (XVIII, 30); Massee **14** (XVIII, 58). On stems. Von Höhnel (*Frag. Myk.* No. 713) considered this a synonym of *L. rubellula* (Desm.) von Höhnel.

Leptosphaeria Parmeliarum (Phill. & Plowr.) Sacc. in *Syll.* II, 83; Berl. **98** (I, 61*); *Sphaeria* Phill. & Plowr. in **14** (IV, 124*, 1876); Plowr. Exs. III, No. 52; *Psilosphaeria* Cooke & Plowr. in **14** (VII, 84); *Melanomma* Cooke in **14** (XVI, 53); Massee **14** (XVI, 118); *Heptameria* Cooke in **14** (XVIII, 33); Massee **14** (XVIII, 60). On *Parmelia*, Dolgelly. Vouaux **117** (XXIX, 75, 1913) transferred this to *Phaeospora*. See Keissler **119**, 430.

— **pellita** (Rabenh. & Klotz.) Sacc. Grove **27** (LXVIII, 73) considered the same as *L. dolioloides*); Currey **45** (XXII, 331*, 1859) as *Sphaeria*; Cooke **15**, 902; Bucknall **46** (II, 218); *Heptameria* Cooke in **14** (XVIII, 31); Massee **14** (XVIII, 58). On *Atriplex*.

— **pellita** var. **cirsiicola** Grove in **27** (LIV, 186, 1916). On *Cirsium*. Ireland.

— **personata** Niessl. *Heptameria* Cooke in **14** (XVIII, 31, 1889); Massee **14** (XVIII, 58); Plowr. Exs. III, No. 84 as *Sphaeria* [n. comb.?]. On *Glyceria*, Norfolk.

— **Phormii** Grove in **37** (1921, 150); **27** (LX, 173, 1922). On *Phormium*, Scotland.

— **pontiformis** (Fuckel) Sacc. Cooke **14** (V, 120, 1877) as *Sphaeria*; *Heptameria* Cooke in **14** (XVIII, 32); Massee **14** (XVIII, 59). On grasses, Norfolk.

— **praetermissa** (Karst.) Sacc. Stevenson **40** (VII, 114, 1884) as *Sphaeria*; Phill. & Plowr. **14** (XIII, 77). On *Rubus*, Scotland.

— **purpurea** Rehm. Grove **27** (LXVIII, 97, 1930) with suggested synonyms. On *Cirsium*, Worcs. See *Pleospora rubicunda*.

— **rubelloides** (Plowr.) Sacc. in *Syll.* II, 77; *Sphaeria* Plowr. apud Cooke in **14** (V, 120, 1877); Bucknall **46** (IV, 60); *Heptameria* Cooke in **14** (XVIII, 32); Massee **14** (XVIII, 59). Type on *Agropyron repens*, Norfolk. Berlese **98** (I, 84) thought it a synonym of *L. culmifraga*.

— **rubicunda** Rehm in Wint. Grove **27** (L, 49, 1912); Hawley **28** (IX, 239). On stems.

— **Rusci** (Wallr.) Sacc. A. Lorrain Smith & Ramsbottom **28** (V, 240); **70** (XXI, 398); B. & Br. **19**, No. 639, 1852 as *Sphaeria*; Currey **45** (XXII, 329*); Cooke **27** (IV, 249*, 1866) as *Sphaerella*; **15**, 918; Berk. Exs. 86; Cooke Exs. 166 and II, No. 267; Plowr. Exs. I, No. 96; Vize Exs. 96; *Heptameria* Cooke in **14** (XVIII, 32); Massee **14** (XVIII, 59); *Cryptosphaeria glaucopunctata* Greville in **51**, 362, 1824; *Sphaeria glaucopunctata* Currey in **45** (XXII, 333*, 1859); Berk. **20**, 272, 1836 as *S. atrovirens* var. *Rusci* Fr. On *Ruscus*.

— **Sowerbyi** (Fuckel) Sacc. in *Syll.* II, 78; *Heptameria* Cooke in **14** (XVIII, 32); Massee **14** (XVIII, 60); "*Sphaeria maculans*" in **42**, t. 394, 1802; B. & Br. **19**, No. 641, 1852; Cooke **15**, 894. On *Scirpus*. See Petrak **105** (1925, 220).

— **Tamaricis** (Greville) Sacc. in *Syll.* II, 26; Massee **14** (XVIII, 12): Rilstone **27** (1935, 102); "*Cryptosphaeria Tamariscinis*" Greville in **39**, t. 45, 1823; **51**, 361; *Sphaeria* Greville in **39**, Index; Berk. **20**, 270; Currey **45** (XXII, 324*); Cooke **15**, 893. On *Tamarix*. Berlese **98** (I, 87) found the type specimen to be *Clypeosphaeria Notarisii*.

— **triglochinicola** (Currey) Sacc. in *Syll.* II, 69; *Sphaeria* Currey in **45** (XXIV, 158*, 1863); B. & Br. **19**, No. 1100, 1865; Cooke **15**, 906; *Heptameria* Cooke in **14** (XVIII, 32); Massee **14** (XVIII, 59). On *Triglochin palustre*, Sussex.

— **Typharum** (Desm.) Karst. *Heptameria* Cooke in **14** (XVIII, 32, 1889); Massee **14** (XVIII, 59). On *Typha*.

— **Typharum** f. **Acori** Grove in **27** (LXVIII, 97, 1930). On *Acorus*, Worcs.

— **uliginosa** (Phill. & Plowr.) Sacc. in *Syll.* II, 47; *Sphaerella* Phill. & Plowr. in **14** (X, 74, 1881). On *Stellaria*, Scotland.

— **vagabunda** Sacc. Bucknall **46** (V, 48* and 53, 1886); **14** (XVIII, 12); **28** (III, 42); **27** (LVIII, 239); **34** (VII, 189). On *Pyrus*, etc.

— **vectis** (Berk. & Br.) Ces. & de Not. in *Comm. Soc. Crittog. Ital.* I, 236; Sacc. II, 74; *Sphaeria* B. & Br. in **19**, No. 779*, 1854; Cooke **15**, 904; Vize Exs. 494; Cooke Exs. 677 and II, No. 251; Plowr. Exs. III, No. 61; *Heptameria* Cooke in **14** (XVIII, 32); Massee **14** (XVIII, 59). On *Iris*.

Massaria argus (Berk. & Br.) Fresen. in *Beitr. Mycol.* p. 59; Tul. **114** (II, 227); Sacc. II, 7; Cooke **15**, 844; Massee **14** (XVIII, 9); Exs. from Broome in Rabenh. *Herb. Mycol.* III, No. 259, 1860; *Sphaeria* B. & Br. in **19**, No. 626*, 1852; Currey **45** (XXII, 325*). On *Betula*.

Massaria Corni (Fr. & Mont.) Sacc. Currey **45** (XXII, 326*, 1859) as *Sphaeria gigaspora* Desm.; Berk. **18**, 398, 1860; Cooke Exs. 257; Massee **14** (XVIII, 9) in error as *Massaria gigaspora* Fuckel. On *Cornus*.

— **foedans** (Fr.) Fr. emend. Fuckel. Cooke **15**, 845, 1871; Massee **14** (XVIII, 9); Plowr. Exs. II, No. 48; *Sphaeria amblyospora* B. & Br. in **19**, No. 627*, 1852; Currey **45** (XXII, 326*); **68**A (IV, 198*). On *Ulmus*.

— **inquinans** (Tode ex Fr.) Fr. Berk. **18**, 402, 1860; Cooke **15**, 846, p.p.; Massee **14** (XVIII, 9); Cooke Exs. 251; Plowr. Exs. II, No. 48; Berk. **20**, 269, 1836 as *Sphaeria*; Currey **45** (XXII, 327*); *S. ellipsosperma* Sowerby in **42**, t. 372, 1802. On *Acer*.

— **macrospora** (Desm.) Sacc. Massee **14** (XVIII, 9); Currey **68**A (VII, 333*, 1859) as *Sphaeria*; *Cucurbitaria* Tul. in **114** (II, 221); Cooke **15**, 841; Plowr. Exs. II, No. 45; *Melogramma oligosporum* B. & Br. in **19**, No. 895*, 1859; **19**, No. 971; Berk. **18**, 391. On bark.

— **pupula** (Fr.) Tul. in **114** (II, 225); Cooke **15**, 845; Massee **14** (XVIII, 9); Bucknall **46** (IV, 202); *Hercospora* Berk. in **18**, 402, 1860. On *Philadelphus*.

Melanomma Aspegrenii (Fr.) Fuckel. B. & Br. **19**, No. 879*, 1859 as *Sphaeria*; Cooke **15**, 870; *Conisphaeria* Stevenson in **13**, 397; *Cucurbitaria* Cooke in **14** (XV, 85); Massee **14** (XVI, 34). On *Prunus*.

— **brachythele** (Berk. & Br.) Sacc. in *Syll.* II, 111; *Sphaeria* B. & Br. in **19**, No. 877*, 1859; Cooke **15**, 871; *Amphisphaeria* Cooke in **14** (XVI, 89); Massee **14** (XVII, 5). On *Sambucus*. Berlese **98** (I, 38) considered the type specimen to be an *Amphisphaeria*.

— **Epochnii** (Berk. & Br.) Sacc. in *Mich.* I, 344; *Syll.* II, 104; *Sphaeria* B. & Br. in **19**, No. 1177*, 1866; Cooke **15**, 865; Vize Exs. 498; Plowr. Exs. III, No. 49; *Byssosphaeria* Cooke in **14** (XV, 123); Massee **14** (XVI, 36). On *Corticium*. Von Hohnel (*Mitteil. Bot. Inst. Tech. Hochs. Wien*, VI, 54, 1929) considered this to be *Naetrocymbe fuliginea* Koerb.

— **fuscidulum** Sacc. Bucknall **46** (V, 52, 1886); Chesters **28** (XXII, 122*); *Sphaeria* [n.comb.?] Phill. & Plowr. in **14** (X, 73, 1881). On wood.

— **Jenynsii** (Berk. & Br.) Sacc. in *Syll.* II, 101; *Sphaeria* B. & Br. in **19**, No. 875*, 1859; Cooke **15**, 870; *Conisphaeria* Stevenson in **13**, 397; *Amphisphaeria* Cooke in **14** (XVI, 89); Massee **14** (XVII, 5). On wood. Berlese **98** (I, 38) considered this to be a *Lophiotrema* near *L. praemorsum*.

— **longicolle** Sacc. Grove **27** (XXIV, 132, 1886). On *Acer*, Warwicks.

— **medium** Sacc. & Speg. Massee **37** (1909, 374 as "*M. nudum*"). On *Tamarix*.

— **obliterans** (Berk. & Br.) Sacc. in *Syll.* II, 101; *Sphaeria* B. & Br. in **19**, No. 890*, 1859; Cooke **15**, 874; *Conisphaeria* Stevenson in **13**, 398; *Amphisphaeria* Cooke in **14** (XVI, 89); Massee **14** (XVII, 5); *Zignoella* Berlese in **98** (I, 96). On "fir poles".

— **Pulvis-pyrius** (Pers. ex Fr.) Fuckel. Massee **14** (XVI, 118); **7**, 229; Chesters **113** (1935, 105*) and **28** (XXII, 116*), considered to be the best lectotype of the genus; Hooker **92**, 8, 1821 as *Sphaeria*; Greville **39**, t. 152, 1825; Berk. **20**, 265; B. & Br. **19**, No. 622, 1852; Currey **45** (XXII, 317*); Cooke **15**, 865; Cooke Exs. 379 and II, No. 488; Vize Exs. 177; Plowr. Exs. I, No. 72; *Psilosphaeria* Stevenson in **13**, 387, 1879; *Cucurbitaria conglobata* "Klot." apud Cooke in **14** (XV, 85); **14** (XVI, 34) as *C. conglobata* "Fr."; see Chesters, loc. cit. Common on wood and bark.

— **pyriostictum** Cooke in **14** (XV, 83, 1887); Sacc. IX, 808; Massee **14** (XVI, 118). On wood, Twycross.

— **Rhododendri** Rehm. *Sphaeria* Phill. & Plowr. in **14** (VIII, 108, 1880); Plowr. Exs. III, No. 47. On *Rhododendron*, the Wrekin.

— **Stevensonii** (Berk. & Br.) Sacc. in *Syll.* II, 104; Massee **14** (XVI, 118); *Sphaeria* B. & Br. in **19**, No. 1728, 1878 and No. 1926, 1881; Cooke **14** (X, 52); *Psilosphaeria* Cooke & Plowr. in **14** (VII, 84, 1879); Stevenson **13**, 388; Bucknall **46** (IV, 60, 1883); *Ceratostomella* Sacc. in *Syll.* I, 412; Massee **14** (XVII, 73). On wood. Berlese **98** (I, 38) thought the type specimen might be *Physalospora*; the specimen in Herb. Kew. is *Trichosphaeria myriocarpa*.

Melanomma vile (Fr.) Fuckel. Berk. **19**, No. 184, 1841 as *Sphaeria*; Cooke **15**, 871; *Conisphaeria* Stevenson in **13**, 397, 1879; *Strickeria* Cooke in **14** (XVI, 54); Massee **14** (XVI, 119); **7**, 230. On wood.

Melogramma elongatum A. L. Smith in **28** (VI, 150, 1919); Sacc. XXIV, 1016. On wood, Scotland.

— **spiniferum** (Wallr.) de Not. Boodle & Dallimore **37** (1911, 338 and 342); A. Lorrain Smith **28** (VI, 150); **70** (XXI, 399); B. & Br. **19**, No. 600, 1851 as *Sphaeria podoides* Pers.; Currey **45** (XXII, 271*); Cooke **15**, 817 as *Diatrype podoides*. On *Fagus*.

— **vagans** de Not. Massee **14** (XV, 39); Currey **45** (XXII, 284*, 1858 as *Sphaeria melogramma*; Berk. **18**, 391 as *M. fusisporum*; Cooke **15**, 801 as *M. Bulliardi*; Cooke Exs. II, No. 673. On *Carpinus*.

Ohleria obducens Wint. Phill. & Plowr. **14** (VI, 27, 1877); Bucknall **46** (V, 52); Plowr. Exs. III, No. 66 as *Sphaeria*. On *Ulmus*. Berlese **98** (I, 28) considered "Phillips Fungi Brit. Exs." to be *O. rugulosa* Fuckel.

Pseudovalsa aglaeostoma (Berk. & Br.) Sacc. in *Syll.* II, 137; *Valsa* B. & Br. in **19**, No. 862*, 1859; Cooke **15**, 838; Massee **14** (XV, 119); Bucknall **46** (IV, 202). On *Ulmus*. Berlese **98** (I, 49) considered the type specimen to be a *Calospora*.

— **aucta** (Berk. & Br.) Sacc. in *Syll.* II, 138; Berl. **98** (I, 48*); Massee **14** (XV, 120); *Sphaeria* B. & Br. in **19**, No. 628*, 1852; Cooke **15**, 887; *Calospora* Fuckel in *Symb. Myc.* p. 191; *Cryptospora* Tul. in **114** (II, 152). On *Alnus*.

— **Berkeleyi** (Tul.) Sacc. in *Syll.* II, 137; *Melanconis* Tul. in *Comp. Rend.* XLII, 703, 1856; **114** (II, 130); Cooke **15**, 819; *Sphaeria inquinans* var. *Ulmi* B. & Br. in **21** (1851, 320*). On *Ulmus*. Berlese **98** (I, 48) and Oudemans referred this to *P. convergens*. Petrak **102** (1923, 324) named it *Prosthecium inquinans* (B. & Br.) Petrak.

— **convergens** (Tode ex Fr.) Sacc. Massee **14** (XV, 120); Sowerby **42**, t. 374, 1802 as *Sphaeria*; Berk. **20**, 252; Currey **45** (XXII, 280*); Cooke **15**, 836 as *Valsa*. On *Platanus*.

— **fusca** Bucknall in **46** (V, 46* and 51, 1886); Sacc. IX, 820. On *Acer*.

— **hapalocystis** (Berk. & Br.) Sacc. in *Mich.* I, 44; *Syll.* II, 138; Massee **14** (XV, 120); *Sphaeria* B. & Br. in **19**, No. 615*, 1852; Cooke **15**, 839 as *Valsa*; Cooke Exs. 253 and II, No. 229. On *Platanus*. Petrak **102** (1923, 324) transferred this to *Prosthecium*.

— **lanciformis** (Fr.) Ces. & de Not. Massee **14** (XV, 120); **7**, 224; Chesters **113** (1935, 104*); Berk. **20**, 243, 1836 as *Sphaeria*; Currey **45** (XXII, 272*) and **66** (CXLVII, 551*); Cooke **15**, 820 as *Melanconis*; Plowr. Exs. II, No. 24; *S. betulina* Sowerby in **42**, t. 371, 1802; Rhodes **108** (1933, 49) as *Pseudovalsa Betulae* ([Schum.]) Schroet. On *Betula*.

— **longipes** (Tul.) Sacc. Massee **14** (XV, 120); **7**, 224; *Melanconis* Tul. in **114** (II, 139); Cooke **15**, 820; Plowr. Exs. II, No. 25; Berk. **20**, 243, 1836 as "*Sphaeria quercina*"; Currey **45** (XXII, 272); see Tul. **114** (II, 98); B. & Br. **19**, No. 839, 1859 as "*Diatrype quercina*"; *Stromatosphaeria quercina* Grev. p.p. in **51**, 358, 1824; *Sphaeria arcuata* Currey in **45** (XXII, 281*). On *Quercus*. See also *Diatrypella quercina*.

— **umbonata** (Tul.) Sacc. Massee **14** (XV, 120, 1887). On *Quercus*, Kew. Wehmeyer **100** (XVIII, 267) regards this as a syn. of *P. lanciformis*.

Rebentischia unicaudata (Berk. & Br.) Sacc. in *Nuovo Giorn. Bot. Ital.* VIII, 12; *Syll.* II, 12; Berl. **98** (I, 29); *Sphaeria* B. & Br. in **19** No. 886*, 1859; Cooke **15**, 892; Bucknall **46** (IV, 202); *Heptameria* Massee in **14** (XVIII, 60). On *Clematis*.

Sporormia ambigua Niessl. Recorded **28** (VII, 8). See Appendix I.

— **bipartis** Cain. Winifred M. Page **28** (XXIII, 253*, 1939). On dung.

— **Brassicae** Grove in **27** (XXIV, 132, 1886); Sacc. *Addit. I-IV*, 151. On *Brassica*, Staffs.

— **fimetaria** de Not. Massee & Salmon **33** (XV, 347*, 1901). On dung, Scotland.

Sporormia intermedia Auersw. Cooke & Plowr. **14** (VII, 86, 1879); Massee **14** (XVI, 120); Bucknall **46** (III, 69); **33** (XV, 348; XVI, 58); **32** (XXXII, 178, spore discharge); **34** (XVII, 290); Rhodes **108** (1933, 47); *Sphaeria Sporormia* Cooke in **15**, 866, 1871; Plowr. Exs. I, No. 73. On dung.

— **lagopina** Bres. Rea **28** (III, 378, 1912). On dung, Scotland. Determined by Boudier, who thought it wrongly placed as var. of *S. intermedia* in Sacc. XIV, 577.

— **leporina** Niessl. Massee & Crossland **7**, 231, 1905. On dung, Yorks.

— **lignicola** Phill. & Plowr. in **14** (VI, 29*, 1877); Sacc. II, 128; Massee **14** (XVI, 120). On old wood, Norfolk.

— **longipes** Massee & Salm. in **33** (XV, 346*, 1901); Sacc. XVII, 737. On dung, Kew.

— **Marchaliana** Mouton. Plowr. **28** (I, 63*, 1899). On dung, Norfolk.

— **megalospora** Auersw. Phill. & Plowr. **14** (VI, 29, 1877); Stevenson **13**, 395; **33** (XV, 348). On dung.

— **microspora** Plowr. in **14** (I, 63*, 1899); Sacc. XVI, 526. On dung, Norfolk.

— **minima** Auersw. Stevenson **13**, 396, 1879; Phill. & Plowr. **14** (VIII, 108, 1880); **33** (XV, 348; XVI, 74); Cooke Exs. II, No. 567. On dung.

— **Notarisii** Caresti. Stevenson **13**, 396, 1879; Massee **14** (XVI, 120); *Sphaeria* Cooke [n.comb.?] in **14** (IV, 113, 1876); Cooke Exs. II, No. 568. On dung.

— **octomera** Auersw. Phill. & Plowr. **14** (VI, 29*, 1877); Stevenson **13**, 396; Massee **14** (XVI, 120). On dung, Scotland.

— **ovina** (Desm.) Sacc. Massee & Salmon **33** (XV, 346*, 1901). On dung, Kew.

— **pascua** Niessl. Crossland **35** (1907, 103); **115**, 34. On dung, Yorks.

— **pulchella** Hansen. Massee & Salmon **33** (XV, 347*, 1901). On dung. See *Sporormiella* below.

— **pulchra** Hansen. Stevenson **13**, 396, 1879; Phill. & Plowr. **14** (VIII, 108*, 1880); **14** (XVI, 120). On dung.

Sporormiella nigropurpurea Ellis & Everh. Massee & Salmon **33** (XV, 348*, 1901, perhaps the same as *Sporormia pulchella*). On dung, Kew.

Thyridaria rubronotata (Berk. & Br.) Sacc. in *Syll.* II, 141; Chesters **28** (XXII, 116*); Berl. **98** (I, 45*); *Melogramma* B. & Br. in **19**, No. 894, 1859; Tul. **114** (II, 243, with suggestion that it is on the remains of *Nectria* or *Nitschkia*); Cooke **15**, 802; Massee **14** (XV, 39). On *Ulmus*. See *Leptosphaeria dioica*.

Trematosphaeria anglica (Sacc.) Sacc. in *Syll.* II, 115; *Melanomma* Sacc. in *Mich.* II, 152, 1880; *Amphisphaeria* Cooke in **14** (XVI, 90); Massee **14** (XVII, 5). Type on *Fraxinus*, Norfolk. Berlese **98** (I, 34*) considered this a variety of *Melanomma* (*Trematosphaeria*) *pertusa*.

— **callicarpa** Sacc. Bramley **35** (1936, 213) as *Melanomma*. On wood, Yorks.

— **lunaria** (Currey ex Cooke) Sacc. in *Syll.* IX, 814; "*Sphaeria lunariae*" Currey ex Cooke in **14** (XVI, 92, 1888); *Amphisphaeria* Cooke in **14** (XVI, 90); Massee **14** (XVII, 5). On *Fraxinus*.

— **megalospora** (de Not.) Sacc. Grove **27** (LXXI, 282*, 1933). On *Quercus*, Lancs.

— **melina** (Berk. & Br.) Sacc. in *Syll.* II, 118; *Sphaeria* B. & Br. in **19**, No. 888*, 1859; Cooke **15**, 890; *Amphisphaeria* Cooke in **14** (XVI, 90); Massee **14** (XVI, 5). On *Fraxinus*. Berlese **98** (I, 38) says the type specimen is *Clypeosphaeria Notarisii* f. *lignicola*.

— **paradoxa** Wint. Crossland **35** (1913, 27 and 175) as *Melanomma*. On *Quercus*, Yorks.

— **pertusa** (Pers. ex Fr.) Fuckel. **71** (XXI, 6, Ireland); Berk. **20**, 266, 1836 as *Sphaeria*; B. & Br. **19**, No. 878*, Currey **45** (XXII, 320*); Plowr. Exs. III, No. 50; *Conisphaeria* Stevenson in **13**, 397; Bucknall **46** (III, 69, 1880); *Amphisphaeria* Cooke in **14** (XVI, 90); Massee **14** (XVII, 5). On wood.

SPHAERIACEAE: DICTYOSPORAE

All are Phaeodictyae except the first two and *Pleosphaerulina* and *Rhamphoria*, which are Hyalodictyae.

Berlesiella nigerrima (Bloxam ex Currey) Sacc. gen.nov. in *Revue Myc.* x, 7, 1888; *Sphaeria* Bloxam ex Currey in **45** (xxii, 272, 1858); B. & Br. **19**, No. 869*, 1859; Cooke **15**, 871 p.p.; Vize Exs. 291; *Psilosphaeria* Stevenson in **13**, 388; *Pleospora*? Sacc. in *Syll.* ii, 276; *Homostegia* Sacc. in **14** (xiii, 62, 1885); **14** (xv, 37); Theiss. & Syd. **102** (1915, 607). On *Diatrype*.

Capronia sexdecemspora (Cooke) Sacc. gen.nov. in *Syll.* ii, 289; *Sphaeria* Cooke in **15**, 860, 1871; *Coniochaeta* Cooke in **14** (xvi, 38); **7**, 228; *Pyrenophora* Cooke in **14** (xviii, 64); Massee **14** (xix, 12). On branches, Shere. Now known only from Cooke's unpublished illustration.

[**Cucurbitaria acervata** (Fr.) Fr. Cooke **15**, 841; Berk. **19**, No. 98, 1858 as *Sphaeria*; Currey **45** (xxii, 283*). On *Pyrus*, Apethorpe. British specimens were *Nitschkia*, q.v.]

Cucurbitaria Aspegrenii Ces. & de Not. Massee **14** (xvi, 35, 1887); **14** (xvi, 47); **37** (1897, 142); **7**, 226. On *Prunus*.

— **Berberidis** (Pers. ex Fr.) S. F. Gray ex Greville in **39**, Index, 1828; Sacc. ii, 308; Gray, *Nat. Arr. Brit. Pls.* i, 519, 1821; Tul. **114** (ii, 219); Cooke **15**, 841; Massee **14** (xvi, 34); Plowr. Exs. i, No. 56; Vize Exs. 160; Cooke Exs. 582 and ii, No. 497; Greville **39**, t. 84, 1824 as *Sphaeria*; Berk. **20**, 254; Currey **45** (xxii, 282*). On *Berberis* and *Mahonia*. See Welch **100** (1926, 51) for *Cucurbitaria*.

— **bicolor** Fuckel. Massee **37** (1909, 374). On *Prunus*, Kew.

— **Dulcamarae** (Kunze & Schm. ex Fr.) Fr. Phill. & Plowr. **14** (ii, 188, 1874); **14** (xvi, 35); Plowr. Exs. ii, No. 46. On *Solanum Dulcamara*, Norfolk.

— **elongata** (Fr.) Greville in **39**, t. 195, 1827; Sacc. ii, 309; Tul. **114** (ii, 217); Massee **14** (xvi, 35); **7**, 226; **37** (1909, 374); Berk. **20**, 255 as *Sphaeria*. On *Robinia*, etc.

— **Euonymi** Cooke in **14** (iii, 67, 1874); Sacc. ii, 320; Massee **14** (xvi, 35); Cooke Exs. 683 (type). On *Euonymus*, Surrey.

— **homalea** (Fr.) Sacc. Berk. **18**, 391, 1860 as *Melogramma*; Cooke **15**, 802, description from a specimen from Fries; Massee **14** (xv, 39). On *Acer Pseudoplatanus*.

— **Laburni** (Pers. ex Fr.) de Not. Cooke **15**, 840; Massee **14** (xvi, 35); **65** (xxx, 349); Mary Green **28** (xvi, 289*); **112**, 178; Plowr. Exs. i, No. 53; Vize Exs. 162; Cooke Exs. ii, No. 498; Berk. **20**, 253, 1836 as *Sphaeria*; Currey **45** (xxii, 282*). On *Cytisus*.

— **Laurocerasi** Prill. & Plowr. in **14** (x, 72*, 1881); Sacc. ii, 314; Stevenson **40** (vii, 114); Massee **14** (xvi, 35). On *Prunus Laurocerasus*, Scotland.

— **naucosa** (Fr.) Fuckel. Cooke **15**, 842; Massee **14** (xvi, 35); B. & Br. **19**, No. 974*, 1861 as *Sphaeria*. On *Ulmus*.

— **Piceae** Borthwick in **57** (iv, 261*, 1909); Sacc. xxii, 289; **64** (xxxi, 73, 1917). On *Picea*, Scotland.

— **pithyophila** (Schm. & Kunze ex Fr.) de Not. A. Lorrain Smith **28** (iii, 42, 1908); **64** (xxix, 209). On conifers, Scotland. Mentioned by M. Ward **56** (xiv, 149, 1892) but not definitely known then in Britain. Petrak **102** (1921, 201) proposed the genus *Cucurbidothis* for this species.

— **Rhamni** (Nees ex Fr.) Fuckel. Phill. & Plowr. **14** (vi, 26, 1877); Massee **14** (xvi, 35); **7**, 226; Plowr. Exs. iii, No. 25. On *Rhamnus*.

— **Ribis** Niessl. Massee **14** (xvi, 35, 1887). On *Ribes*, Middlesex.

— **Spartii** (Nees in Fr.) Ces. & de Not. Cooke **15**, 840, 1871; Massee **14** (xvi, 35); Rhodes **108** (1933, 47); Cooke Exs. 388; Plowr. Exs. i, No. 55; Currey **45** (xxii, 283*, 1858 as *Sphaeria*, thought to be the same as *C. elongata*); **68** A (vii, 234); Grove **1** (ii, 104). On *Sarothamnus* and *Ulex*.

Fenestella bipapillata (Tul.) Sacc. Phill. & Plowr. **14** (xv, 78, 1887). On *Fagus*, Scotland.

Fenestella fenestrata (Berk. & Br.) Schroet. in *Krypt. Fl. Schles.* II, 435, 1908; *Valsa* B. & Br. in **19**, No. 853*, 1859; Cooke **15**, 837; Bucknall **46** (v, 51); *F. princeps* Tul. in **114** (II, 207, 1863); Massee **14** (xv, 120). On *Quercus*, etc.

— **Lycii** (Hazsl.) Sacc. Plowr. **54** (III, 751); Massee **14** (xv, 120, 1887). On *Lycium*, Norfolk.

— **minor** Tul. in **114** (II, 207). Saccardo II, 327 considered that *Valsa tetratrupha* Berk. & Br. (in **19**, No. 852*, 1859; Cooke **15**, 837) belonged here: this name cannot be transferred to *Fenestella* because Saccardo (*Syll.* II, 326) called another fungus *F. tetratrupha* Sacc. Massee **14** (xv, 120, 1887) and **7**, 224, however, used the name "*F. tetratrupha* B. & Br." On *Alnus* and *Salix*. See *Pleospora eustegia*.

— **Salicis** (Rehm) Sacc. Massee **14** (xv, 120, 1887). On *Salix*, Kew.

— **vestita** (Fr.) Sacc. Massee **14** (xv, 120); **7**, 224; Currey **66** (CXLVII, 546*, 1857) as *Sphaeria*; **45** (XXII, 280*, 1858); B. & Br. **19**, No. 866, 1859 as *Valsa*; Cooke **15**, 839. On *Fagus* and *Ulmus*.

Karstenula rhodostoma (Alb. & Schw. ex Fr.) Speg. Currey **45** (XXII, 323*, 1859) as *Sphaeria*; Phill. & Plowr. **14** (VI, 26) as *Massaria*; Massee **14** (XVIII, 10); Plowr. Exs. III, No. 27. On *Rhamnus*, Norfolk.

Pleomassaria holoschista (Berk. & Br.) Sacc. in *Syll.* II, 239; Berl. **98** (II, 2*); *Sphaeria* B. & Br. in **19**, No. 977*, 1861; Rabenh. *Fungi Eur.* No. 446, 1862, coll. Broome; Tul. **114** (II, 233, 1863) under *Massaria* (but not formally transferred); Cooke **15**, 847 as "*M. holoschista* Tul."; Massee **14** (XVIII, 10). On *Alnus*, Wilts.

— **siparia** (Berk. & Br.) Sacc. in *Syll.* II, 239; *Sphaeria* B. & Br. in **19**, No. 625*, 1852; Currey **66** (CXLVII, 552*, 1858) and **45** (XXII, 326*, 1859); Rabenh. *Fungi Eur.* III, No. 260, coll. Broome; *Massaria* Ces. & de Not. in *Schema*, p. 43; Tul. **114** (II, 232); Cooke **15**, 844; Bucknall **46** (III, 69); Massee **14** (XVIII, 10); Plowr. Exs. II, No. 47. On *Betula*.

Pleosphaerulina hyalospora (Ellis & Everh.) Berl. Carter **28** (XIX, 146, 1935). From air over orchards.

Pleospora abscondita Sacc. & Roum. var. **divisior** Grove in **27** (LXVIII, 102*, 1930). On *Juncus*, Wales.—For *Pleospora* see Berlese, "Monografia dei generi *Pleospora*, *Clathrospora* e *Pyrenophora*", *Nuovo Giorn. Bot. Ital.* XX, 1888, cited below as "Berl. Monog." See also **98** (II, 4–29).

— **Allii** (Rabenh.) Ces. & de Not. Massee **14** (XIX, 12, 1890). On *Allium*, Twycross. Teste Berl. Monog. = *P. herbarum*.

— **Armeriae** (Rabenh.) Ces. & de Not. Berl. Monog. p. 125; Grove **27** (1930, 270); **70** (XXI, 398) as form of *P. herbarum*. On *Armeria*.

— **Asparagi** Rabenh. Massee **14** (XIX, 12, 1890); Plowr. Exs. III, No. 76 as *Sphaeria*; Cooke Exs. II, No. 494; Vize Exs. 186 as *S. herbarum* var. On *Asparagus*. Teste Berl. Monog. = *P. herbarum*.

— **Bardanae** Niessl. Massee **14** (XVIII, 89, 1890) and **37** (1897, 143); Berl. Monog. p. 29. On *Buddleia*, Kew Gardens.

— **Clematidis** Fuckel. Grove **27** (LXVIII, 100*, 1930); Rhodes **108** (1933, 48). On *Clematis*, Worcs. Teste Berl. Monog. = *P. Vitalbae* (de Not.) Berl.

— **culmorum** (Cooke) Sacc. in *Syll.* II, 263; Berl. Monog. p. 39*; Massee **14** (XVIII, 89); *Sphaeria* Cooke in **14** (III, 68, 1874; VII, 87); Cooke Exs. 694 and II, No. 260. On grass.

— **denotata** (Cooke & Ellis) Sacc. in *Syll.* II, 251; Massee **14** (XVIII, 89, 1890). On *Glaucium*, Kew.

— **Dianthi** de Not. Massee **14** (XVIII, 89, 1890); *Sphaeria* [comb.n.?] in Plowr. Exs. III, No. 74. On Dianthus. Teste Berl. Monog. = *P. herbarum*.

— **donacina** (Fr.?) Niessl. Berl. Monog. p. 50; Phill. & Plowr. **14** (VI, 27, 1877) as *Sphaeria*. On *Arundo Donax* (cult.), Leominster.

— **Equiseti** A. L. Smith in **28** (III, 116*, 1909); Sacc. XXII, 276. On *Equisetum*, Scotland.

— **Euonymi** Fuckel. Crossland **35** (1915, 145). On *Euonymus*, Yorks.

— **Euonymi** f. **caulicola** Grove in **27** (LXXI, 285, 1933). On twigs of *Euonymus*, Worcs.

Pleospora eustegia (Cooke) Sacc. in *Syll.* II, 255; *Sphaeria* Cooke in **15**, 893, 1871; Cooke Exs. 387; *Delacourea* Cooke in **14** (XVII, 92); Massee **14** (XVIII, 12); *Valsa tetratrupha* var. *simplex* Cooke in **27** (IV, 101*, 1866); see *Fenestella minor* above. On *Salix*. Berlese **98** (II, 28) found the type specimen sterile.

— **Gymnocladi** Bagnis. Massee **37** (1909, 375). On *Gymnocladus*, Kew. Teste Berl. Monog. = *P. herbarum*.

— **hepaticola** Watson in **28** (IV, 295, 1914); Sacc. XXIV, 1025. On *Lophocolea*, Devon.

— **herbarum** (Pers. ex Fr.) Rabenh. Tul. **114** (II, 260, 1863); Massee **14** (XVIII, 89); **28** (X, 101; XIV, 224; XVI, 102; XIX, 147 and 284); **22** (Bull. 79, p. 57); **23** (XLIII, 124); **31** (LXXXIX, 35); **33** (XLVIII, 363); **65** (XXX, 259); **78** (1930, 133); **79** (I, 19 and 28; II, 18; XI, 36 and 48); **85** (XXXIII, 19); Hooker **92**, 7, 1821 as *Sphaeria*; Berk. **20**, 276; Currey **45** (XXII, 332*); **68**A (III, 266*); Cooke **15**, 896; Plowr. Exs. I, No. 86 and III, Nos. 77–80; Berk. Exs. 267; Cooke Exs. 261 and II, Nos. 257–9, 494, and 693–6. Several other names in *Pleospora* belong here; see Berl. Monog. p. 91. On apples, lettuce, and many other hosts.

— **herbarum** var. **Cichorii** Cooke & Massee in **14** (XVII, 79, 1889).

— **herbarum** var. **glumarum** Berk. & Br. (as *Sphaeria*) in **19**, No. 641, 1852.

— **herbarum** var. **Iridis** Cooke in **14** (XIII, 99, 1885), Kew.

— **hydrophila** Karst. Berl. Monog. p. 53; A. Lorrain Smith **28** (VI, 151, 1919). On *Alisma*, Scotland.

— **infectoria** Fuckel. Massee **14** (XVIII, 90); **79** (I, 18 and 28, on oats); **70** (XXI, 398, in Ireland); Hawley **28** (IX, 239); Cooke **15**, 897, 1871 as *Sphaeria* [comb.n.?]; Cooke Exs. II, No. 699; Plowr. Exs. II, No. 75 and III, No. 72; Vize Exs. 188. On grasses. See Berl. Monog. p. 56.

— **Junci** Pass. & Beltr. Berl. Monog. p. 115; Grove **27** (LXVIII, 101*, 1930). On *Juncus*, Wales.

— **juncigena** Cooke in **14** (XIX, 8, 1890 as "*junciginea*"); Sacc. IX, 879; nom. nud. in **14** (XVIII, 90). On *Juncus*, N. Wootton. Berlese **98** (II, 12*) made this a variety of *P. infectoria*.

— **laminariana** Sutherland in **28** (V, 260*, 1916); Sacc. XXIV, 1024. On *Laminaria*, Dorset and Orkney.

— **leguminum** (Wallr.) Rabenh. Massee **14** (XVIII, 89); **7**, 236; Cooke **15**, 897, 1871 as var. On Leguminosae. Teste Berl. Monog. = *P. herbarum*.

— **Meliloti** Rabenh. in Sacc. Berl. Monog. p. 87; Massee **14** (XVIII, 89, 1890); **7**, 236. On *Melilotus*.

— **Meliloti** var. **Medicaginis** Cooke & Massee in **14** (XVII, 79, 1889). On *Medicago*, Kew. Oudemans *Enumerat.* III, 852 cites this as a synonym of *Leptosphaeria Medicaginis*.

— **palustris** Berl. in *Nuovo Giorn. Bot. Ital.* XX, 67*, 1888; "*Sphaeria Heleocharis*" in **14** (VI, 27, 1877); **14** (VII, 27; XIX, 12); Plowr. Exs. III, No. 81; Cooke Exs. II, No. 689. On *Eleocharis*, Norfolk.

— **Pelvetiae** Sutherland in **32** (XIV, 41*, 1915); Sacc. XXIV, 1024. On *Pelvetia*.

— **pentamera** Karst. Berl. Monog. p. 77; Massee & Crossl. **7**, 236, 1905. On grass, Yorks.

— **Pisi** (Sowerby ex Fr.) Fuckel in *Symb. Myc.* p. 131; Sacc. II, 248; Massee **14** (XVIII, 89); *Sphaeria* Sowerby in **42**, t. 393, 1803; Berk. **20**, 275; Currey **45** (XXII, 331*); Plowr. Exs. III, No. 75; Cooke **15**, 897 as var. of *P. herbarum*; Vize Exs. 185. On Leguminosae. Teste Tul. **114** (II, 262) and Berl. Monog. = *P. herbarum*.

— **platyspora** Sacc. Massee **14** (XVIII, 89, 1890). On *Euphorbia*, Darenth. *Clathrospora* Berl. in Monog., p. 197.

— **pomorum** Horne in **27** (LVIII, 239, 1920); **31** (Oct. 30, 1920, p. 216); **34** (VII, 183, 1920); **93**, 130; **28** (X, 100; XIV, 160); **22** (Misc. Publ. 38, p. 69); **112**, 192; **67** (B CII, 427 and 444), and probably other reports in the literature of plant pathology. On apples. *P. pomorum* may be a synonym of *P. herbarum*.

Pleospora rubicunda Niessl. Bucknall **46** (v, 53, 1886); Massee **14** (xviii, 89); Grove **27** (lxviii, 97, perhaps the same as *Leptosphaeria purpurea* Rehm); Phill. & Plowr. **14** (vi, 27, 1877) as *Sphaeria* [comb.n.?]; **14** (vii, 87); Plowr. Exs. iii, Nos. 70, 71. On *Juncus*, *Phragmites*, and *Chenopodium*. See Berl. Monog. p. 140.

— **Salsolae** Fuckel. Berl. Monog. p. 121; Massee **14** (xviii, 89, 1890). On *Salicornia*, Bungay.

— **samarae** Fuckel. *Delacourea* Cooke in **14** (xvii, 93, 1889); Massee **14** (xviii, 12); Plowr. Exs. iii, No. 73 as *Sphaeria*; Vize Exs. 292; Cooke Exs. ii, No. 691. On samaras of *Fraxinus*. Teste Berl. Monog. = *P. herbarum*.

— **scirpicola** (DC. ex Fr.) Karst. Massee **14** (xviii, 90); Berl. Monog. p. 68; Berk. **20**, 275, 1836 as *Sphaeria*; B. & Br. **19**, No. 641, 1852; Cooke **15**, 883; Vize Exs. 99; Cooke Exs. ii, No. 496; Plowr. Exs. ii, No. 65, and ? No. 66 as var. *graminis*. On *Scirpus*. See *P. typhicola*.

— **Scrophulariae** (Desm.) von Hohnel. Berk. **20**, 276, 1836 as *Sphaeria*; Currey **68**A (iv, 198 and 201*, 1856) as *S. herbarum* var. *Scrophulariae*; Cooke **15**, 897; Plowr. Exs. i, No. 87; Cooke Exs. ii, No. 376. On *Scrophularia*. Von Höhnel (*Frag. Myc.* No. 1044, 1917) and Petrak **105** (1925, 238) consider this an earlier name for *P. vulgaris*.

— **Sparganii** Cooke in **14** (xix, 8, 1890 as "*Spargani*"); Sacc. ix, 875; nom. nud. in **14** (xviii, 90). On *Sparganium*, N. Wootton. Berlese **98** (ii, 10*) made it a variety of *P. vagans*.

— **subriparia** (Cooke) Sacc. in *Syll.* ii, 272; Berl. Monog. p. 91; Massee **14** (xix, 12); *Sphaeria* Cooke in **14** (v, 121, 1877). On *Carex*, Norfolk.

— **Thujae** Grove in **27** (l, 49, 1912); Sacc. xxiv, 1028. On cone-scales of *Thuja*, Studley Castle.

— **typhicola** (Cooke) Sacc. in *Syll.* ii, 264; Berl. Monog. p. 40*; Massee **14** (xviii, 90); *Sphaeria* Cooke in **14** (v, 121, 1877); Bucknall **46** (iii, 220); "*Macrospora Scirpi*" in **14** (ii, 48, 1873); "*Sphaeria Scirpi*" in **14** (ii, 164); ?**32** (xxxii, 178) as "*Pleospora Scirpi*"; Plowr. Exs. ii, No. 74 and ? iii, No. 69. On *Typha*.

— **vagans** Niessl. Bucknall **46** (v, 48* and 54, 1886); Grove **27** (lxviii, 101). On *Dactylis* and *Phragmites*. See Berl. Monog. p. 49.

— **verecunda** (Currey) Sacc. in *Syll.* ii, 245; Berl. Monog. p. 158; Massee **14** (xviii, 89); *Sphaeria* Currey in **45** (xxiv, 158*, 1863); B. & Br. **19**, No. 1099, 1865; Cooke **15**, 882; Bucknall **46** (ii, 349). On sticks.

— **vulgaris** Niessl. Massee **14** (xviii, 89); **7**, 235; Rhodes **108** (1933, 48); Phill. & Plowr. **14** (vi, 27, 1877) as *Sphaeria vulgaris* "*forma monosticha*". On herbs. Berl. Monog. p. 46, considered this a synonym of *P. infectoria*. See *P. Scrophulariae* above.

Pyrenophora Avenae Ito. Dennis **28** (xix, 288*, 1935). Asci recorded on *Avena sativa* in Scotland.

— **calvescens** (Fr.) Sacc. Massee **14** (xix, 12); Bucknall **46** (v, 54, 1886); *Pleospora* Tul. in **114** (ii, 266); Berl. Monog. p. 25. On *Atriplex*.

[— **graminea** Ito & Kuribay. This fungus has been reported, e.g. **24** (ii, 535, 1919); **34** (xvi, 1929), but no perithecia are known in Britain. See Ainsworth **93**.]

— **phaeocomes** (Rebent. ex Fr.) Fr. Cooke **15**, 925, 1871; Massee **14** (xix, 12); Cooke Exs. 600; Berk. **20**, 276, 1836 as *Sphaeria*; *S. capillata* Greville in **39**, t. 69, 1824. On grasses. See Berl. Monog. p. 214, next entry, and **7**, 236.

— **phaeocomoides** Sacc. in *Syll.* ii, 280; Berl. Monog. p. 220; Massee **14** (xix, 12); Bucknall **46** (v, 54); "*Sphaeria phaeocomes*" in **19**, No. 207*, 1841; "*Pyrenophora phaeocomes*" in **18**, 402, 1860. On *Vitis*.

— **teres** Drechsler. Reports of this fungus in Britain, e.g. **24** (v, 414); **34** (xvi, 1929); **65** (xxx, 344), apparently refer only to the *Helminthosporium*. On *Hordeum*.

— **trichostoma** (Fr.) Fuckel. Cooke **14** (v, 122, 1877); Massee **14** (xix, 12); Plowr. Exs. iii, Nos. 86, 87; Cooke Exs. ii, No. 692. On straw, Norfolk. See Berl. Monog. p. 209.

Rhamphoria tympanidispora Rehm. Chesters & Croxall **113** (1937, 153*). On logs of *Quercus*, near Coventry.

Teichospora deflectens Karst. Phill. & Plowr. **14** (x, 73, 1881) as *Sphaeria* [comb.n.?]; Bucknall **46** (III, 269*, 1882). On *Fagus*.

— **obducens** (Fr.) Fuckel. Berk. **19**, No. 100, 1838 as *Sphaeria*; Cooke **15**, 865; Berk. Exs. 177; Plowr. Exs. I, No. 71; *Psilosphaeria* Stevenson in **13**, 387; Bucknall **46** (v, 52); *Strickeria* Cooke in **14** (XVI, 54); Massee **14** (XVI, 119); *S. plateata* Currey in **45** (XXII, 318*, 319). On wood, usually *Fraxinus*. See Berlese **98** (I, 28). Berk. (*Mag. Zool. Bot.* 1838, 223*) apparently figured this species as "*Sphaeria populina* Pers."

Thyridium lividum (Pers. ex Fr.) Sacc. Massee **14** (XVIII, 9); Boyd **28** (IV, 68); Berk. **20**, 267, 1836 as *Sphaeria*; Currey **45** (XXII. 323*); Cooke **15**, 877; *Xylosphaeria* Stevenson in **13**, 398. On *Hedera*. One doubtful record.

SPHAERIACEAE: SCOLECOSPORAE (all Hyaloscoleciae)

Acanthophiobolus helminthosporus (Rehm) Berl. Grove **27** (LXVIII, 131, 1930). On *Quercus*, Worcs. Berlese **98** (II, 137) finally followed Saccardo and placed this in *Ophiochaeta*.

[**Bovilla**, see Sphaeriaceae-Phaeosporae.]

Cryptospora Betulae Tul. in **114** (II, 149, 1863); Rhodes **108** (1933, 49); *Valsa* Cooke in **14** (XIV, 7, 1885); Bucknall **46** (IV, 202, 1885); Massee **14** (XV, 117); Plowr. Exs. II, No. 35. On *Betula*.

— **corylina** (Tul.) Fuckel. Cooke **15**, 830, 1871 as *Valsa*; Massee **14** (XV, 117). On *Corylus*, Shere.

— **intexta** (Currey) Sacc. in *Syll.* II, 362; *Sphaeria* Currey in **45** (XXII, 279*, 1858); *Valsa* B. & Br. in **19**, No. 860, 1859; Cooke **15**, 830; Massee **14** (XV, 117). On *Quercus*, Surrey. Berlese **98** (II, 161) remarked "dubia".

— **Sowerbyi** (Berk. apud Cooke) Sacc. in *Syll.* IX, 939; *Diatrype* Berk. apud Cooke in **14** (XV, 67, 1887), with Sowerby t. 378 f. 14 cited. On branches, Scotland, Herb. Sowerby. Berlese **98** (II, 161) found spores 20 × 4–5 μ and suggested *Calospora* or *Valsa*.

— **suffusa** (Fr.) Tul. in **114** (II, 145, 1863); Rhodes **108** (1933, 49); Berk. **18**, 390 as *Valsa*; Cooke **15**, 829; **14** (XV, 117); **27** (XLVII, 349); Cooke Exs. 247 and II, No. 223; Plowr. Exs. II, No. 34; Vize Exs. 169; Currey **45** (XXII, 279*) as *Sphaeria*; B. & Br. **19**, No. 983, 1861; *S. Rabenhorstii* B. & Br. in **19**, No. 631, 1852; *S. Cryptosporii* Currey in **68**A (III, 271*, 1855; IV, 199*); Sacc. II, 361. On *Alnus*.

Dilophia graminis (Fuckel) Sacc. Anon., **23** (XXII, 937, 1916). On wheat, England. Conidial?

Isothea saligna (Fr.) Berk. in **18**, 392, 1860; Cooke **15**, 932; Cooke Exs. II, No. 668; Berk. **20**, 233, 1836 as *Phoma*; Berk. Exs. 191; *Sphaeria salicina* Sowerby in **42**, t. 372, 1802; Sacc. II, 354 as *Linospora Capreae* (DC.) Fuckel; Wheldon **40** (1911, 37); Grove **1** (I, 103). On fallen leaves of *Salix*.

Linospora populina ([Pers.]) Schroet. Cooke **15**, 930, 1871 as *Hypospila*; Berk. **20**, 258, 1836 as *Sphaeria ceuthocarpa* Fr.; Currey **45** (XXII, 286*, 1858). On dry leaves of *Populus*. Fries used the name "*ceuthocarpa*" in the *Systema*.

— **Viburni** (Bucknall apud Cooke) Berl. & Vogl. in Sacc. *Addit. I–IV*, 191; *Hypospila* Bucknall apud Cooke in **14** (XII, 44, 1883); Bucknall **46** (IV, 150, 1884; v, 50*); Cooke **14** (XII, 44); Massee **14** (XV, 37). On leaves of *Viburnum*, Bristol.

Naumovia abundans Dobrozr. Ramsbottom **28** (XIX, 91, 1934); **71** (XLII, 50, 1934). On *Prunella*, England, Ireland and Scotland. First listed **28** (XVII, 12, 1932); see Appendix I. Shear **100** (XXIX, 361) transferred it to *Gibberidea*.

Ophiobolus acuminatus (Sowerby ex Fr.) Duby in Rabenh. *Herb. Myc.* Ed. II, No. 57; Sacc. II, 340; *Sphaeria* Sowerby in **42**, t. 394, 1803; Berk. **19**, No. 189*, 1841; B. & Br. **19**, No. 639; Currey **45** (XXII, 331*); Cooke **15**, 899; Cooke

Exs. 264 and II, No. 253; Vize Exs. 294; Plowr. Exs. I, No. 88; *Rhaphidospora* Cooke in **14** (XVIII, 16); Massee **14** (XVIII, 42); *Leptosphaeriopsis* Berl. in **98** (II, 140). Common on stems of herbs.

Ophiobolus Bardanae (Fuckel) Rehm. Rilstone **27** (1935, 102) on *Arctium*; **28** (XXI, 3) on *Heracleum*.

— **cariceti** (Berk. & Br.) Sacc. in *Syll.* II, 349; *Sphaeria* B. & Br. in **19**, No. 983, 1861; Cooke **15**, 901; Bucknall **46** (III, 270); *Rhaphidospora* Cooke in **14** (XVIII, 16); Massee **14** (XVIII, 42). On sedges etc. See *O. graminis*. Berlese **98** (II, 119) thought *O. cariceti* a synonym of *O. eucryptus*.

— **erythrosporus** (Riess) Wint. Cooke **15**, 899, 1871 as *Sphaeria Urticae* Rabenh.; Bucknall **46** (V, 54); Massee **14** (XVIII, 42) as *Rhaphidospora Urticae*. On *Urtica*.

— **eucryptus** (Berk. & Br.) Sacc. in *Syll.* II, 350; Berlese **98** (II, 119); *Sphaeria* B. & Br. in **19**, No. 652*, 1852; Cooke **15**, 901; *Rhaphidospora* Cooke in **14** (XVIII, 16); Massee **14** (XVIII, 42). On *Carex* (and *Iris*?).

— **fruticum** (Rob. & Desm.) Sacc. Grove **27** (LXVIII, 102, 1930). On *Ononis*, Worcs.

— **graminis** Sacc. Carruthers **63** ((2) VIII, 213*, 1872) and W. G. Smith **81**, 69*, 1884 described the mycelium now known to belong to *O. graminis*; the name was apparently first used for a British record **23** (XI, 154, 1904); **23** (XIV, 355; XIX, 1020; XLIII, 159); Massee **5**, 226 and **37** (1912, 435*, on *Triticum*, *Avena*, *Agropyron repens*, *Bromus*); Jones **33** (XL, 607*, on *Avena* in Wales, development of perithecia); **22** (Misc. Publs. 52, 70, 79); **63** (1927, 313); **65** (XXX, 344, Scotland); **79** (I, 9 and 28; IV, 4; V, 24; XI, 43); **85** (XLI, 15); **93**, 12; **112**, 92; **34** (XXII, 225; XXIII, 45 and 667), and other recent papers; for a time following **100** (1922, 36) the name *O. cariceti* was used; **79** (III, 3); **85** (XXIV, 149; XXV, 142; XXVI, 165; XXVII, 87; XXVIII, 49; XXXI, 13); **103** (XIX, 472). On cereals and grasses.

· — **halimus** Diehl & Mounce. Tutin (ref. in *Rev. Appl. Myc.* XVI, 481). On *Zostera*, Britain.

— **helicosporus** (Berk. & Br.) Sacc. in *Syll.* II, 350; *Sphaeria* B. & Br. in **19**, No. 653, 1852; Cooke **15**, 901; *Rhaphidospora* Cooke in **14** (XVIII, 17); Massee **14** (XVIII, 42). On *Carex*. See Berlese, **98**.

— **herpotrichus** (Fr.) Sacc. Mary Glynne **28** (XX, 122, 1936, on *Triticum*); Berk. **19**, No. 26, 1837 as *Sphaeria*; Cooke **15**, 900; Bucknall **46** (VI, 144); Plowr. Exs. II, No. 78; Massee **14** (XVIII, 42) as *Rhaphidospora*. On grasses.

— **immersus** Trail. Trail **40** (X, 70, 1889); Sacc. IX, 923. On *Urtica*, Scotland. First described by Trail from Norway.

— **intermedius** (Berl.) Grove in **27** (LXVIII, 102, 1930). On *Galium*, Cornwall. Berlese had described this as a variety of *O. vulgaris*.

— **Laminariae** Sutherland in **28** (V, 147*, 1915); Sacc. XXIV, 1062. On *Laminaria*, Scotland.

— **nigrificans** Sacc. in *Syll.* II, 343, a correction of the specific name and a transfer of "*Sphaeria nigrofactae*" Cooke in **14** (II, 164, 1874); "*Xylosphaeria nigrofacta*" Cooke in **14** (VII, 86); *Rhaphidospora nigrificans* Cooke in **14** (XVIII, 16); Massee **14** (XVIII, 42). On *Brassica*, Eastbourne.

— **rubellus** (Pers. ex Fr.) Sacc. Berk. **20**, 274, 1836 as *Sphaeria*; Currey **45** (XXII, 331*); Cooke **15**, 899; Cooke Exs. 252, 274 and II, No. 688; Vize Exs. 295; Plowr. Exs. II, No. 77; **14** (XVIII, 42) as *Rhaphidospora*; **37** (1897, 142); **7**, 234; Grove **27** (XXIII, 161, 1885) as *Metasphaeria*; **27** (LXVIII, 97). Common on stems. Sacc. in *Syll.* II used Tode's name "*porphyrogona*", but this is invalid since Fries accepted "*rubella*".

— **tenellus** (Auersw.) Sacc. Hawley **28** (IX, 239, 1924). On *Galium*.

— **ulnasporus** (Cooke) Sacc. in *Syll.* II, 339; **98** (II, 131*); *Sphaeria* Cooke in **15**, 900*, 1871; **73** (III, 79); Bucknall **46** (III, 69); Cooke **14** (XVIII, 16) as *Rhaphidospora*; Massee **14** (XVIII, 42). On *Urtica*.

— **vulgaris** (Sacc.) Sacc. Phill. & Plowr. **14** (XIII, 78, 1885); Bucknall **46** (V, 54, 386). On stalks of *Solanum tuberosum*.

Ophioceras bacillatum (Cooke) Sacc. in *Syll.* II, 360; *Sphaeria* Cooke in **15**, 879, 1871; *Ceratostomella* Cooke in **14** (XVII, 50); Massee **14** (XVII, 74); *Acerbia* Berl. in **98** (II, 142*). On wood, Shere.

Sillia ferruginea (Pers. ex Fr.) Karst. Chesters **113** (1936, 128*); Hooker **92**, 6, 1821 as *Sphaeria*; Berk. **20**, 244; Currey **45** (XXII, 272*); Cooke **15**, 815 as *Diatrype*; Massee **14** (XV, 69); Plowr. Exs. I, No. 38; *Hillia* Cooke in **14** (XIV, 14); **7**, 221 as *Melogramma*. On *Corylus*.

HYPOCREALES

NECTRIACEAE

With the few exceptions indicated, we follow the classification of Petch's recent paper, designed especially to help the collector.

Actinopsis peristomialis (Berk. & Br.) Petch in **28** (XXI, 282*, 1938); *Peziza* B. & Br. in **19**, No. 1169, 1866; Cooke **15**, 706; Nannfeldt **28** (XX, 201) as *Peristomialis Berkeleyi* Boud. On *Hedera*, Penzance.

Apiocrea chrysosperma (Tul.) Syd. Petch **27** (LXXV, 221) and **28** (XXI, 275*); B. & Br. **19**, No. 1832, 1879 as *Hypomyces*; Phill. & Plowr. **14** (VIII, 104, 1880); **14** (XI, 4*; XV, 5); **40** (V, 234, 1880). On *Boletus* and other fungi.

— **Tulasneana** (Plowr.) Petch in **27** (LXXV, 220, 1937); **28** (XXI, 275); *Hypomyces* Plowr. in **14** (XI, 46*, 1882); Sacc. II, 473; *Peckiella* Sacc. in *Syll.* IX, 944; B. & Br. **19**, No. 594, 1851 as *Hypocrea luteovirens*; Currey **45** (XXII, t. 46); B. & Br. **19**, No. 1101, 1865 and No. 1175 as *Hypomyces luteovirens*. On *Boletus*. See Petch, **27**, on confusion of the specific epithet *luteovirens*.

Barya aurantiaca Plowr. & Wilson in **31** (9 Feb. 1884, 176*); Petch **28** (XXI, 284*); **40** (VII, 230); *Claviceps Wilsoni* Cooke in **14** (XII, 77, Mar. 1884, and p. 100); **89**, 238*, 1906; *C. purpurea* var. *Wilsoni* W. G. Smith in **81**, 233*, 1884. On *C. purpurea* on *Glyceria* near Aberdeen.

Battarrina inclusa (Berk. & Br.) Clem. & Shear gen.nov. in **29**, 279, 1931; **28** (XXI, 247*, 1938); *Hypocrea* B. & Br. in **19**, No. 970*, 1867; Cooke **15**, 776; 14 (XV, 3). In *Tuber puberulum*, Bristol. The name *Batterina* was used as a subgenus in *Syll.* II, 533.

Byssonectria lateritia (Fr.) Petch in **27** (LXXV, 220, 1937); **28** (XXI, 248*); Berk. **20**, 238, 1836 as *Sphaeria*; **21** (1842, 44); Currey **45** (XXII, 267*); Cooke **15**, 779 as *Hypomyces*; Plowr. **14** (XI, 41*, 42*); *Merulius helvelloides* Sowerby in **42**, t. 402, 1809; Cooke Exs. II, No. 667 as *Hypomyces torminosus*; Vize Exs. 587; Plowr. Exs. II, No. 4; B. & Br. **19**, No. 593 as *Hypocrea floccosa*? On *Lactarius*.

— **viridis** ([Alb. & Schw.]) Petch in **27** (LXXV, 220, 1937); **28** (XXI, 248); Phill. & Plowr. **14** (VIII, 104*, 1880) as *Hypomyces*; **14** (X, 42; XV, 5); *H. ater* Fr. ex Cooke in **14** (XII, 80, 1884); **14** (XIII, 47; XV, 5); *H. luteovirens* (Fr.) Plowr. in **14** (XI, 46*). On *Lactarius*, etc.

Calonectria erubescens (Rob. in Desm.) Sacc. Petch **28** (XXI, 278); Bucknall **46** (III, 138*, 1881) as *Nectria* [comb.n.?]; Phill. & Plowr. **14** (X, 70, 1881); Vize Exs. 589. On leaves of *Ilex*.

— **graminicola** (Berk. & Br.?) Wollenw. F. A. Mason, *Bull. Bureau Biotech.* 1923, 78; **112**, 163; **86** (1931, 116); Bennett **34** (XX, 277) and **86** (1933, 79). This name is used by the Plant Path. Comm. of the Brit. Myc. Soc. for *Fusarium nivale*, the pathogen of turf grasses. Bennett (loc. cit.) obtained immature perithecia but as he points out it is very doubtful whether this is Berkeley & Broome's species *Nectria* [*Dialonectria*, q.v.] *graminicola*.

[— **Leightoni** (Berk.) Sacc. Petch **27** (LXXIV, 186) says that the British specimen is a lichen.]

— **minutissima** Grove in **27** (LXVIII, 31*, 1930); Petch **28** (XXI, 279). On *Eleocharis*, Staffs.

Calonectria ochraceopallida (Berk. & Br.) Sacc. in *Fungi Ven.*, Ser. iv; *Syll.* ii, 551; Petch **28** (xxi, 278); *Sphaeria* B. & Br. in **19**, No. 607, 1851; *Nectria* Berk. in **18**, 394; Tul **114** (iii, 95); Cooke **15**, 786; *Dialonectria* Cooke in **14** (xii, 111); *Calonectria Plowrightiana* Sacc. in *Mich.* i, 307; *Nectria Plowrightiana* Cooke & Plowr. in **14** (vii, 78); *Dialonectria Plowrightiana* Cooke in **14** (xii, 111). On stems and branches. See Weese, *Mycol. Centralb.* iv, 180.

— **platasca** (Berk.) Sacc. in *Mich.* i, 308; *Syll.* ii, 546; Petch **28** (xxi, 279); *Sphaeria* Berk. in **20**, 263, 1836; *Nectria* Berk. in **18**, 393; **15**, 785; *Dialonectria* Cooke in **14** (xii, 111). On *Acer*, Northants. Petch **27** (lxxiv, 186) found no perithecia on the type specimen.

— **Pseudopeziza** (Desm.) Sacc. Mrs N. L. Alcock & Foister **65** (xxx, 349, 1931). On *Laburnum*, Scotland.

— **tessellata** Petch in **28** (xxi, 301 and 279*, 1938). On *Brassica* and twigs of *Pyrus*.

— **xantholeuca** (Fr.) Sacc. Listed by Corner **28** (xix, 284, 1935), Wicken Fen, Cambs.

Cesatiella lancastriensis Grove in **27** (lxviii, 132*, 1930); Petch **28** (xxi, 283*). On wet wood, Lancs.

Dialonectria arenula (Berk. & Br.) Cooke in **14** (xii, 110); Petch **28** (xxi, 265); *Sphaeria* B. & Br. in **19**, No. 622*, 1852; *Nectria* Berk. in **18**, 394; Sacc. ii, 492; see Tul. **114** (iii, 96). On *Aira*.

— **Brassicae** (Ellis & Sacc.) Cooke in **14** (xii, 110); Petch **28** (xxi, 264, 1938). On *Brassica*, Norfolk, 1935.

— **Desmazierii** (de Not.) Petch in **35** (1937, 281); **28** (xxi, 265); Wollenw. *Fus. autog. del.* t. 1104c as *Nectria*; *Sphaeria sanguinea* var. *cicatricum* Berk. in **19**, No. 25*, 1837; Berk. Exs. 83. On twigs of *Buxus*.

[— **galligena** (Bres.) Petch in F. A. Mason & Grainger **115**, 32, 1937; **35** (1937, 381); **28** (xxi, 265*). The references below are as *Nectria*. Dorothy Cayley **33** (xxxv, 79*, 1921, life history, previously confused with *N. ditissima*); **23** (xxxiv, 162; xl, 53); **25** (xxv, 272; xxxiv, 97); **34** (vii, 152, 1921; ix, 275; xii, 398); **65** (xxx, 338); **77** (1924, 135; 1926–7, 92; 1928–30, 125; 1931, 47; 1933, 166); **79** (i, 29; v, 26 and 30; vi, 27; xi, 37, 50 and 52; xii, 24); **85** (xxvi, 165; xxxi, 14; xxxiii, 20; xxxix, 18); **96** (iii, 130); **104** (ii, 102, 1921; ii, 271; iii, 161; ix, 295); **112**, 160*; Bennett, *Outline of Fungi and Plant Diseases*, p. 147*. On *Pyrus*, *Fraxinus*, etc.]

— **graminicola** (Berk. & Br.) Cooke in **14** (xii, 110); Petch **28** (xxi, 265); *Nectria* B. & Br. in **19**, No. 897*, 1859; Tul. **114** (iii, 96); Cooke **15**, 787; Sacc. ii, 492. On *Aira caespitosa*, Batheaston, 1859. This fungus, which has one-septate ascospores, is probably not the same as *Calonectria graminicola*, q.v.

— **Peziza** (Tode ex Fr.) Cooke in **14** (xii, 110); Petch **28** (xxi, 263); Hooker **92**, 7, 1821 as *Sphaeria*; Greville **39**, t. 186, 1826; Berk. **20**, 262; Currey **45** (xxii, t. 57); Berk. Exs. 176; B. & Br. **19**, No. 971, 1861 as *Nectria*; Plowr. Exs. ii, No. 7 and iii, No. 7; *N. epigaea* Cooke in **14** (viii, 10, 1879); Stevenson **13**, 362, 1879; *Byssonectria epigaea* Cooke in **14** (xii, 109); *Nectria aurea* (Grev.?) Cooke in **14** (viii, 9); Stevenson **13**, 361; *Dialonectria aurea* Cooke in **14** (xii, 110); **14** (xv, 8). On old wood, etc. Petch places *Sphaeria aurea* Greville in **39**, t. 47, 1823 with *Hypomyces aurantius* p.p.

— **sanguinea** (Bolton ex Fr.) Cooke in **14** (xii, 110); Petch **28** (xxi, 264); *Sphaeria* Bolton in **111**, t. 121, 1789; Sibthorp *Fl. Oxon.* p. 404, 1794; Sowerby **42**, t. 254; Greville **39**, t. 175; Berk. **20**, 263; Currey **45** (xxii, t. 57); Cooke **15**, 785 as *Nectria*; Baxter Exs. 75; Plowr. Exs. iii, No. 8; Greville **39**, t. 175, 1825 as *S. episphaeria* Tode; Berk. **20**, 263; Currey **45** (xxii, t. 57); Cooke **15**, 785 as *Nectria episphaeria*; Plowr. Exs. i, No. 11; *S. Purtoni* Greville in **39**, t. 23, 1823; Currey **45** (xxii, 282*); *Nectria Purtoni* (Grev.) Cooke in **15**, 786; Sacc. ii, 498; Tul. **114** (iii, 92). On old wood and Sphaeriales.

— **Veuillotiana** (Sacc. & Roum.) Cooke in **14** (xii, 110); Petch **28** (xxi, 266, 1938). Two collections, one on *Fagus*.

— **Wegeliana** (Rehm) Petch in **28** (xxi, 266, 1938). On *Diatrypella*.

[**Eleutheromyces subulatus** (Tode ex Fr.) Fuckel. British specimens examined by Petch **27** (LXXIII, 187) were found to be pycnidial.]

[**Erostrotheca multiformis** Martin & Charles. The conidia only, *Cladosporium album* Dowson = *Hyalodendron album* (Dowson) Diddens, known in Britain.]

Gibberella acervalis (Moug. in Fr.) Sacc. Petch **27** (LXXV, 226, 1937) and **28** (XXI, 281). On *Salix*, Norfolk.

— **Buxi** (Fuckel) Wint. Petch **28** (XXI, 281, 1938). On twigs of *Buxus*, 1934.

— **cyanogena** (Desm.) Sacc. Petch **28** (XXI, 280); **102** (XXXIV, 277); Massee **14** (XV, 9, 1886); **27** (XXIV, 133, 1886); Plowr. **28** (I, 64); Cooke **15**, 843 as *Gibbera Saubinetii*; Bucknall **46** (II, 349); Cooke Exs. II, No. 499; Plowr. Exs. I, No. 58; B. & Br. **19**, No. 868, 1859 as *Sphaeria Saubinetii* Mont.; Massee **14** (XV, 9, 1886) as *Gibberella Saubinetii*; **37** (1909, 375). Common on old stems of *Brassica*, etc. See *G. Zeae* below.

— **flacca** (Wallr.) Sacc. Massee **14** (XV, 9); Phill. & Plowr. **14** (VI, 25, 1877) as *Gibbera*; **14** (VII, 84). On *Solanum Dulcamara*, locality not given.

— **moricola** (de Not.) Sacc. Reported **77** (1926–27, 83, 1928) on *Morus*, Hants.

— **pulicaris** (Fr.) Sacc. Petch **28** (XXI, 280*); Massee **14** (XV, 9); Bennett **34** (XXII, 496); Berk. **19**, No. 175, 1841 as *Sphaeria*; Currey **45** (XXII, 282*); Berk. Exs. 253; Cooke **15**, 780 as *Nectria*; Tul. **114** (III, 67); Cooke Exs. II, No. 473; Plowr. Exs. I, No. 6; Vize Exs. 272. On stems and branches.

— **Saubinetii** (Mont.) Sacc. This name is used by the Plant Path. Comm. of the Brit. Myc. Soc. to include the species on cereals and grasses. See next and *G. cyanogena*.

— **Zeae** (Schwein.) Petch in **102** (XXXIV, 260, 1936); **28** (XXI, 281); **23** (XXXVI, 6) as *G. Saubinetii*; **34** (XVII, 43; XVIII, 158; XX, 377); **112**, 163. On cereals and grasses.

[**Gibsonia phaeospora** Massee. See under *Melanospora* "*cirrhata*".]

Hyphonectria aureonitens (Tul.) Petch in **27** (LXXV, 220, 1937); **28** (XXI, 271*); Phill. & Plowr. **14** (X, 70, 1881) as *Hypomyces*; **14** (XI, 49*; XV, 6); *Nectriopsis* Maire in **102** (IX, 323). On *Stereum*. As Petch notes, *Nectriopsis* is the valid generic name.

— **Berkeleyana** (Plowr. & Cooke) Petch in **27** (LXXV, 220, 1937); **28** (XXI, 271); *Hypomyces* Plowr. & Cooke in **14** (XI, 48*, 1882); **14** (XV, 6); *Nectriopsis* Maire in **102** (IX, 324); "*Nectria rosella*" in **19**, No. 971*, 1861; Cooke **15**, 778 p.p. On *Stereum*, *Polyporus*, etc.

— **muscivora** (Berk. & Br.) Petch in **28** (XXI, 270, 1938); *Sphaeria* B. & Br. in **19**, No. 608, 1851; *Nectria* Berk. in **18**, 394; Cooke **15**, 786; *Dialonectria* Cooke in **14** (XII, 110); **14** (XV, 8); recorded **7**, 214 as *Byssonectria bryophila* (Rob. in Desm.) Cooke [in **14** (XII, 109)] but Petch **35** (1937, 283) considers this to have been *Dialonectria Peziza*. On mosses.

— **Solani** (Reinke & Berth.) Petch in **27** (LXXV, 220, 1937); **28** (XXI, 272); Pethybridge **28** (VI, 11, 1918) as *Hypomyces*; ?**23** (I, 59, 1894). On decaying potato tubers, Ireland.

— **violacea** (Schmidt in Fr.) Petch gen.nov. in **27** (LXXV, 220, 1937); **28** (XXI, 271); *Nectriopsis* Maire in **102** (IX, 323) Phill. & Plowr. **14** (VIII, 104, 1880) as *Hypomyces*; **40** (V, 234, 1880); **60** (XVI, 41, 1880); **14** (XI, 49*; XV, 5); *Hypomyces candicans* Plowr. in **14** (XI, 50*, 1882, nom. nud. in X, 70); **14** (XV, 6); Grove **27** (XXIII, 132, 1885, on *Stemonitis*). *Fuligo septica* is the usual substratum.

Hypomyces asterophorus Tul. Petch **28** (XXI, 274); Plowr. **14** (XI, 6, 1882); **14** (XV, 5). On *Nyctalis*, Norfolk.

— **aurantius** (Pers. ex Fr.) Tul. Petch **28** (XXI, 273*); B. & Br. **19**, No. 1102, 1865, and No. 1175; Cooke **15**, 777; **14** (XI, 44*; XV, 6); Plowr. Exs. I, No. 4; Berk. **20**, 259, 1836 as *Sphaeria*; Berk. **18**, 393 as *Nectria*. On *Polyporus*, etc.

[— **Baryanus** Tul. Grove **27** (XXII, 195); **14** (XV, 6). On *Nyctalis*, only conidia known.]

— **Broomeanus** Tul. in **114** (III, 108, 1865); Sacc. II, 469; Petch **28** (XXI, 274); B. & Br. **19**, No. 1175*, 1866; Cooke **15**, 778; Plowr. **14** (XI, 48*); Rabenh. *Fungi Eur.* No. 751 as *Hypocrea luteovirens*, coll. Broome. On *Fomes annosus*.

[**Hypomyces cervinus** Tul. **14** (VIII, 104; XI, 51*; XV, 6). Conidia only, on *Morchella*, etc.]

— **fulgens** (Fr.) Karst. Massee **14** (XV, 6). On *Polyporus*. A very doubtful record.

[— **Linkii** Tul. Bucknall **46** (IV, 150, 1884); **14** (XV, 50*). Conidia only, on *Boletus*, etc.]

[— **miliarius** Tul. Plowr. **14** (XI, 2). Conidia only, on *Russula*, Hereford.]

— **ochraceus** ([Pers.]) Tul. Petch **28** (XXI, 272); **27** (LXXV, 222); Currey **45** (XXII, t. 57, 1859); B. & Br. **19**, No. 1175*, 1866; **14** (XI, 45*); **15**, 777; *Cryptosphaeria aurantia* Greville in **39**, t. 78, 1824; *Hypomyces terrestris* Plowr. & Boud. in **14** (VIII, 105*, 1880); **14** (XI, 47*; XV, 6). On *Russula* and *Lactarius*.

[— **perniciosus** P. Magnus. Massee **33** (XIX, 325); **5**, 192; **23** (XII, 47); F. E. V. Smith **28** (X, 81). The *Mycogone* stage only is known.]

— **rosellus** (Alb. & Schw. ex Fr.) Tul. Petch **28** (XXI, 273); Plowr. **14** (XI, 42*); Cooke **15**, 778; Bucknall **46** (IV, 150); Greville **39**, t. 138, 1825 as *Sphaeria*; Berk. **20**, 259, 1836; Currey **45** (XXII, t. 57); *Nectria Albertini* B. & Br. in **19**, No. 971; Cooke **15**, 784. On *Stereum*, etc. Grove **1** (I, 159) thought that *Sphaeria epimyces* Berk. **19**, No. 187, 1841 was a *Hypomyces* "like *rosellus*".

[— **tuberosus** Tul. Plowr. **14** (XI, 2, 1882). Conidia only known.]

Hyponectria Buxi (Desm.) Sacc. Petch **28** (XXI, 246*), with synonymy; see also **71** (XL, 49); B. & Br. **19**, No. 639, 1852 as *Sphaeria*; Currey **45** (XXII, 283*, 1858); Berk. **20**, 272, 1836 as *S. atrovirens* var. *Buxi*. On leaves of *Buxus*.

Lasionectria aureola (Wint.) Sacc. Petch **28** (XXI, 267); A. Lorrain Smith **28** (III, 41, 1908) as *Nectria*. On *Meliola* on *Vaccinium*, Scotland.

— **flavida** (Corda) Cooke in **14** (XII, 112, 1884); Petch **28** (XXI, 267); **14** (XV, 8); B. & Br. **19**, No. 610, 1851 as *Sphaeria*. On wood.

— **lecanodes** (Ces.) Petch in **28** (XXI, 267*, 1938); Phill. & Plowr. **14** (VI, 25, 1877) as *Nectria*; *Dialonectria* Cooke in **14** (XII, 110); **14** (XV, 8). On lichens. See Keissler **119**, 276.

— **Leptosphaeriae** (Niessl) Petch in **28** (XXI, 268, 1938). On *Leptosphaeria*.

Letendraea helminthicola (Berk. & Br.) Weese. Petch **28** (XXI, 277*); *Nectria* B. & Br. in **19**, No. 896, 1859; Cooke **15**, 787; *Dialonectria* Cooke in **14** (XII, 111); Massee **14** (XV, 8). On *Helminthosporium*. See Sacc. II, 538 as *L. eurotioides* Sacc., the type species of the genus.

Melanospora brevirostris (Fuckel) von Hohnel. Petch **28** (XXI, 253); **27** (LXXIII, 220); *Ceratostoma Helvellae* Cooke in **14** (I, 175, 1873, nom. nud. on p. 143); **14** (VII, 79) as *Melanospora Helvellae*; **14** (XV, 9). On Discomycetes. See *M. Zobelii*.

— **caprina** (Fr.) Sacc. Petch **28** (XXI, 250); **27** (LXXIV, 191); Massee **14** (XV, 9); Cooke **15** 925*, 1871 as *Ceratostoma*; Bucknall **46** (II, 218); Stevenson **13**, 363, 1879 as *M. vervecina*; Phill. & Plowr. **14** (VIII, 105, 1880); **14** (XV, 9). On wood.

— **chionea** (Fr.) Corda. Petch **28** (XXI, 250); Stevenson **13**, 364, 1879; Phill. & Plowr. **14** (VIII, 105, 1880); **14** (XV, 9); **28** (V, 257). On needles of *Pinus*.

— **cirrhata** Berk., nom. nud. in Berk. Exs. 325, 1843; Cooke **14** (XVI, 102). On straw, King's Cliffe. This fungus was provided with an English description by Petch in **27** (LXXIV, 190, 1936) and **28** (XXI, 251*), but no Latin diagnosis has yet been published. Petch **27** (LXXIII, 221) considered that *Gibsonia phaeospora* Massee gen.nov. in **33** (XXIII, 336*, 1909, on *Saprolegnia*) might be the same. If so, *phaeospora* is the valid epithet.

— **damnosa** (Sacc.) Lindau. Petch **28** (XXI, 253, 1938). On *Ulmus*, Kew, 1932.

— **destruens** (Shear) Shear. Asthana and Lillian Hawker **33** (L, 325 and 699, 1936); Lillian Hawker **28** (XX, 313), physiology of sporulation. This fungus is not one of the Hypocreales.

— **discospora**´ Massee & Salm. in **33** (XV, 352*, 1901). On dung, "Kew". Petch **27** (LXXIV, 188) found only *Chaetomium murorum* on the type specimen, and while Massee & Salmon figured a perithecium of *Melanospora*, the spores were apparently those of *Chaetomium*.

— **fimbriata** (Rostrup) Petch in **28** (XXI, 253, 1938); Massee & Salmon **33** (XV, 351*, 1901) as *Sphaeroderma*. On dung, Kew. Petch saw no specimen.

[**Melanospora gigantea** Massee & Crossl. in **7**, 215, 1905 and *Sphaeroderma gigantea* Massee & Crossl. in Crossl. **35** (1901, 341) are nomina nuda, teste Petch **27** (LXXIII, 221). No *Melanospora* was found by Petch on Crossland's specimen.]

— **lagenaria** (Pers. ex Fr.) Fuckel. Petch **28** (XXI, 252); Cooke **14** (XVI, 102, 1888); **28** (II, 93; VI, 47). On *Polyporus*.

— **leucotricha** Corda. Petch **28** (XXI, 251); **28** (III, 210; XIX, 146). On leaves, etc. Petch found no British specimen.

— **parasitica** Tul. Petch **28** (XXI, 252; XVII, 178); Cooke **14** (X, 71*, 1881; XV, 9). On entomogenous fungi.

— **sphaerodermoides** Grove in **27** (XXIII, 132*, 1885); Sacc. IX, 950; Petch **28** (XXI, 253). On stems, Warwicks and Norfolk.

[— **vitrea** (Corda) Sacc. *Sphaeronema blepharistoma* Berk. in **19**, No. 57*, 1837 and No. 196, 1841; see Sacc. XX, 1270 as *M. vitrea*. Petch **27** (LXXIV, 189) finds this fungus to be a *Sphaeronemella*.]

— **Zamiae** Corda. Petch **28** (XXI, 251); Mason, *Annotated Acct. Fungi recd. at I.M.I.*, List II, fasc. 2, 1933; *Ampullaria aurea* A. Lorrain Smith gen.nov. in **27** (XLI, 258*, 1903). On damp, decaying plants.

— **Zobelii** (Corda) Fuckel. Petch **27** (LXXIII, 217) and **28** (XXI, 254); *Ceratostoma* Berk. in **18**, 402, 1860; Cooke **15**, 926; **14** (XV, 9). On truffles. No British specimen was found by Petch who thinks it may prove to be the same as *M. brevirostris*, which was identified as *M. Zobelii* in **28** (IV, 314; VI, 145 and 365).

Nectria Aquifolii (Fr.) Berk. in **18**, 393, 1860; Sacc. II, 487; Petch **28** (XXI, 259); Tul. **114** (III, 87*); Chesters **113** (1936, 127*); Cooke **15**, 782; Massee **14** (XV, 5); Plowr. Exs. II, No. 6; Vize Exs. 373; Cooke Exs. 260; Berk. **20**, 253, 1836 as *Sphaeria*; Currey **45** (XXII, 283*); *N. inaurata* B. & Br. in **19**, No. 781, 1854; **31** (22 July 1854*); **18**, 393*; Currey **68A** (III, 270); **7**, 212; Cooke Exs. II, No. 476; Plowr. Exs. I, No. 10; *Aponectria inaurata* (B. & Br.) Sacc. in *Mich.* I, 296. On *Ilex*.

— **cinnabarina** (Tode ex Fr.) Fr. Petch **28** (XXI, 255); Cooke **15**, 781; **31** (Feb. 28, 1871); Line **28** (VIII, 23, parasitism); **23** (VII, 6; XI, 202; XIV, 107; XVI, 297; **62** (XII, 83; XXIV, 110); **64** (XVII, 344); **65** (XI, 469; XXX, 338); **76** (VI, 125); **77** (1934, 146; 1936, 188); **78** (1919, 32); **79** (XI, 51); **85** (XXVI, 165; XXVII, 87; XXXIII, 21); **94** (XIII, 56 and 139); **112**, 159; Cooke Exs. 259 and II, No. 474; Plowr. Exs. I, No. 7; Berk. **20**, 252, 1836 as *Sphaeria*; Currey **45** (XXII, 282*); *Cucurbitaria* Greville in **39**, t. 135, 1825; Baxter Exs. 26; *S. fragiformis* Sowerby in **42**, t. 256, 1800; Hooker **92**, 6, 1821 as *S. decolorans*; *S. ochracea* Grev. & Fr. in *Elenchus* II, 79, 1828; Berk. **20**, 252; Cooke **15**, 781 as *N. ochracea*; Massee **14** (XV, 5); *N. fuscopurpurea* Wakef. in **37** (1918, 232). Common on branches.

— **citrino-aurantia** (de Lacr.) Desm. Petch **28** (XXI, 261); B. & Br. **19**, No. 1492*, 1875; Cooke **14** (II, 164, 1874; IV, 68; VII, 78); Massee **14** (XV, 5). On *Salix*, Batheaston.

— **coccinea** (Pers. ex Fr.) Fr. Petch **28** (XXI, 257*); Cooke **15**, 782, 1871; **46** (II, 349); Massee **14** (XV, 5); **65** (XXX, 349); **112**, 162; Plowr. Exs. I, No. 8; Vize Exs. 152; Hooker **92**, 7, 1821 as *Sphaeria*; Berk. **20**, 253; Currey **45** (XXII, 282*); Baxter Exs. 25 as *Cucurbitaria*; *S. Mori* Sowerby in **42**, t. 255, 1800. Common on dead branches.

— **Coryli** Fuckel. Petch **28** (XXI, 259, 1938). On branches of deciduous trees and shrubs. See next entry.

— **cucurbitula** (Tode ex Fr., p.p.) Sacc. Petch **28** (XXI, 258) states that most British records refer to *N. Coryli*: Ward **56** (XIV, 138 and 140, 1892); **89**, 225*; **64** (XVII, 279); **68** (1881, 84); **14** (IV, 16; IX, 118; XV, 4); Berk. **19**, No. 174, 1841 as *Sphaeria*; B. & Br. **19**, No. 609, 1851; Currey **45** (XXII, 282*). On coniferous logs. Petch records two localities in Scotland.

— **galligena** Bres. This is the name accepted by the Plant Path. Comm. of the Brit. Myc. Soc. Literature under *Dialonectria*.

Nectria inventa Pethybridge in **28** (VI, 107, 1919); Petch **28** (XXI, 257). On potatoes and *Brassica*, Ireland and Norfolk. The perfect state of *Acrostalagmus cinnabarinus* Corda.

— **Magnusiana** Rehm. Petch **28** (XXI, 260, 1938); conidial stage reported by Grove **27** (LVI, 286, 1918). On *Diatrypella*.

— **mammoidea** Phill. & Plowr. in **14** (III, 126*, 1875); Petch **28** (XXI, 260); **35** (Sept. 1881); **46** (III, 268); **7**, 212; Plowr. Exs. II, No. 5. On *Ulex*, etc.

— **mammoidea** var. **Rubi** (Osterw.) Weese. Petch **28** (XXI, 260); Pethybridge (*Rept. Council Royal Dublin Soc.* for 1916, p. 63) as *N. Rubi*; **28** (XII, 20); Mrs N. L. Alcock **65** (XXIV, 197, 1925; XXX, 340); **78** (1925, 146); **112**, 163. On *Rubus*.

— **ochroleuca** (Schwein.) Berk. Petch **28** (XXI, 261, 1938). On *Ulmus*.

— **pallidula** Cooke in **14** (XVII, 3, 1888); Petch **28** (XXI, 261). On wood.

— **punicea** (Kunze & Schm. ex Fr.) Fr. Petch **28** (XXI, 257); Cooke **27** (IV, 101, 1866); **15**, 781; **46** (VI, 33); **14** (XV, 4); **70** (XXI, 399); *N. ditissima* Tul. in **114** (III, 72, 1865); Phill. & Plowr. **14** (VIII, 105, 1880); **68** (1881, 85); **14** (IX, 116; XV, 5); Plowr. **31** (Mar. 8 and Apr. 19*, 1884); **56** (1888, 52); **89**, 119*; **33** (XXV, 79, comparison with *N. galligena*, with which it was confused); **5B**, 127*; **23** (II, V, VI, VII, VIII, XIII, XIV, XV, XXIV); **37** (1911, 338, 341); **61** (CVI, 581); **56** (XX, XXII, XXIII, XXVII); **103** (IV, 76); **78** (1913, 80; 1914, 94; 1919, 23; 1920, 82; 1921, 70; 1922, 71). On branches.

— **Ralfsii** Berk. & Br. in **19**, No. 780, 1854; Sacc. II, 503; Petch **28** (XXI, 256); Cooke **15**, 783; **35** (Sept. 1881); **14** (XV, 5); **5**, 212. On branches.

— **sinopica** (Fr.) Fr. Petch **28** (XXI, 258); Cooke **15**, 782; **14** (XV, 4); Tul. **114** (III, 89); Cooke Exs. II, No. 477; Plowr. Exs. I, No. 9; Vize Exs. 154; Berk. **19**, No. 97, 1838 as *Sphaeria*; Currey **68A** (III, 270)*. On *Hedera*.

[— **Solani** Reinke & Berth. Recorded **23** (XI, 676; XIII, 739) and **5**, 180*, but Pethybridge **28** (VI, 105) and Petch **28** (XXI, 259) know of no reliable record.]

— **subquaternata** Berk. & Br. in **36** (XIV, 116, 1873); Petch **27** (LXXIV, 187, 1936); **28** (XXI, 256); *N. Keithii* B. & Br. in **19**, No. 1625, 1876; **14** (V, 62, 1876; VII, 78). On *Brassica*.

— **umbrina** (Berk.) Fr. Berk. **18**, 394; Cooke **15**, 788; *Sphaeria* Berk. in **20**, 264, 1836. Petch **28** (XXI, 301) states that this belongs to the Sphaeriaceae.

Nectriella Bloxami (Berk. & Br.) Fuckel in *Symb. Myc.* Nachtr. III, 21, 1875; Petch **28** (XXI, 269); *Nectria* B. & Br. in **19**, No. 781, 1854; Cooke **15**, 787; Tul. **114** (III, 95); *Dialonectria* Cooke in **14** (XII, 110); Massee **14** (XV, 7). On *Helianthus*, Twycross.

— **chrysites** (Westend.) Sacc. Recorded with doubt by Grove **27** (XXIV, 133, 1886) on *Fraxinus*, Warwicks.

— **dacrymycella** (Nyl.) Rehm. Petch **28** (XXI, 269, 1938) found only one specimen, that recorded by Bucknall **46** (III, 268*, 1882) as *N. arenula* on *Iris*. *N. dacrymycella* was recorded, apparently in error, by Phill. & Plowr. **14** (XIII, 78) and by Bucknall **46** (IV, 59).

— **funicola** (Berk. & Br.) Petch in **35** (1937, 281); **28** (XXI, 269); *Sphaeria* B. & Br. in **19**, No. 611, 1851; Cooke **15**, 784 as *Nectria*; *Nectria fibricola* Plowr. apud Sacc. in *Mich.* II; *Dialonectria fibricola* Cooke in **14** (XII, 111); **14** (XV, 8). On rope, etc.

— **Robergei** (Mont. & Desm.) Weese. Petch **28** (XXI, 270*); *Nectria Peltigerae* Phill. & Plowr. in **14** (IV, 123, 1876). On *Peltigera*. See Keissler **119**, 281.

[**Nectriopsis** Maire is the valid name for *Hyphonectria* (Sacc.) Petch, q.v., for species known to have been transferred.]

[**Neocosmospora vasinfecta** E. F. Smith. Russell & Pethybridge **23** (XVIII, 818, 1912), "Wilt fungus of cucumbers and melons".]

Neohenningsia suffulta (Berk. & Curt.) Petch in **28** (XXI, 268*, 1938); *Nectria ornata* Massee & Salm. in **33** (XVI, 75*, 1902). On dung, Kew. Von Hohnel (*Frag. Myk.* No. 755) suggested *Hyphonectria* and *Neohenningsia*, but did not make the combination.

Ophionectria cylindrospora (Sollm.) Berl. & Vogl. Petch **28** (XXI, 284*, 1938). On *Pinus*.

Orcadia Ascophylli Sutherland gen.nov. in **28** (V, 151*, 1914); Sacc. XXIV, 678; Petch **28** (XXI, 283*). On *Ascophyllum*, Orkney.

— **pelvetiana** Sutherland in **32** (XIV, 183*, 1915); Sacc. XXIV, 678; Petch **28** (XXI, 283). On *Pelvetia*.

Paranectria affinis (Grev.) Sacc. gen.nov. in *Mich.* I, 317, 1878; *Syll.* II, 552; Petch **27** (LXXV, 228); **28** (XXI, 282*); *Sphaeria* Grev. in **39**, t. 186, 1826; *Nectria* Fr. in Tul. **114** (III, 95); **13**, 362; **14** (VIII, 9); *Dialonectria* Cooke in **14** (XII, 110); Massee **14** (XV, 8). On *Ephebe*, Scotland.

Pleonectria berolinensis Sacc. Petch **27** (LXXIV, 187, 1927); **28** (XXI, 286*). On *Ribes*. Petch found one specimen doubtfully British. The records of *Nectria Ribis* Rabenh. in **14** (VIII, 105; XV, 4), Vize Exs. 153 and Plowr. Exs. III, No. 11, were found to refer to *N. cinnabarina*; that in **23** (XVII, 301, 1910) was admitted to be uncertain.

— **Lamyii** (Desm.) Sacc. Recorded by Phill. & Plowr. **14** (X, 70, 1881) as *Nectria*; Massee **14** (XV, 5). On *Berberis*. Not included by Petch.

Protocrea delicatula (Tul.) Petch in **27** (LXXV, 219, 1937); **28** (XXI, 276*); B. & Br. **19**, No. 1176, 1866 as *Hypocrea*; Cooke **15**, 775. On old coniferous wood, Lucknam. Other British records erroneous.

— **farinosa** (Berk. & Br.) Petch gen.nov. in **27** (LXXV, 219, 1937); **28** (XXI, 276); *Hypocrea* B. & Br. in **19**, No. 592, 1851; Sacc. II, 529; Cooke **15**, 776; Massee **14** (XV, 3). On old wood and fungi.

Pseudonectria furfurella (Berk. & Br.) Petch in **28** (XXI, 249, 1938); *Nectria* B. & Br. in **19**, No. 1331*, 1871; Cooke **14** (I, 155). On *Brassica*, Batheaston. The type (and only) specimen now appears to be without perithecia, teste Petch.

— **Rousseliana** (Mont.) Wollenw. Petch **28** (XXI, 249*); Tul. **114** (III, 97, 1865) as *Nectria*; Cooke **15**, 788, with vars., see B. & Br. **19**, No. 898, 1859; Bucknall **46** (IV, 59); ?Berk. **19**, No. 182, 1841 as *Sphaeria fulva* Fr. On leaves of *Buxus*.—Wollenweber in *Fus. autogr. del.* No. 665, 1930, appears to have been the first to make the combination *P. Rousseliana*.

Rhynchonectria longispora (Phill. & Plowr.) von Hohnel gen.nov. in *Fragm. Mykol.* No. 32; Petch **28** (XXI, 277); *Eleutheromyces* Phill. & Plowr. in **14** (XIII, 78, 1885); Sacc. IX, 942; **14** (XV, 7); *Eleutherosphaeria* Grove gen.nov. in **27** (XLV, 171, 1907). On *Myxomycetes*. Petch found no specimen. See Grove **27** (1932, 2).

Sphaeroderma episphaerium (Phill. & Plowr.) Sacc. in *Syll.* II, 460; Petch **28** (XXI, 254); **27** (LXXIV, 191); *Melanospora* Phill. & Plowr. in **14** (X, 71*, 1881); **14** (XV, 9). On *Hypomyces*.

— **fusisporum** Petch in **35** (1936, 58); **28** (XXI, 254*). On *Isaria*, Yorks and Norfolk.

— **Hulseboschii** Oudem. Massee & Salmon **27** (XV, 352*, 1901); Petch **28** (XXI, 255, no specimen available). On dung, Surrey.

[— **Sepultariae** Wheldon nom. nud. in **28** (VI, 145, 1919). On *Sepultaria*.]

Sphaerostilbe aurantiaca Tul. Petch **28** (XXI, 262*); Phill. & Plowr. **14** (X, 70, 1881); **14** (XV, 5); *Nectria* Wollenw. in *Fus. autogr. del.* t. 789. On *Ulmus*.

— **flammea** Tul. Petch **28** (XXI, 262; VII, 115, 1921). On scale insects.

— **flavoviridis** Fuckel. Petch **28** (XXI, 263, 1938); Wollenw. *Fus. autogr. del.* t. 1103 as *Nectria*. On wood.

[— **gracilipes** Tul. Recorded by Crossland **7**A, 278, 1904 and **7**, 211. Petch **35** (1937, 283) and **27** (LXXV, 226) found these specimens to be *Stilbella pellucida*.]

Torrubiella aranicida Boud. Petch **28** (XXI, 285*, 1938); **35** (1936, 274; 1937, 282). On spiders, Yorks.

Trailia Ascophylli Sutherland gen.nov. in **28** (V, 149*, 1915); Sacc. XXIV, 690; Petch **28** (XXI, 286*). On *Ascophyllum*, Orkney.

Trichonectria hirta (Bloxam) Petch in **35** (1937, 282); **28** (XXI, 285*); *Nectria* Bloxam apud Currey in **45** (XXIV, 158*, 1863); B. & Br. **19**, No. 1101, 1865; Tul. **114** (III, 108); Cooke **15**, 783; *Lasionectria* Cooke in **14** (XII, 112); Massee **14** (XV, 8); *Calonectria vermispora* Massee & Crossl. in **35** (1904, 4*); **7**A, 279; **7**, 214. On old wood.

HYPOCREACEAE

Chromocrea aureoviridis (Plowr. & Cooke) Petch in **28** (XXI, 293, 1938); *Hypocrea* Plowr. & Cooke in **14** (VIII, 104, 1880); Sacc. II, 525; **14** (XV, 3); **18**A, 360. On *Corylus*, Norfolk, 1879.

— **cupularis** (Fr.) Petch in **28** (XXI, 293, 1938); *Hypocrea dacrymycella* Cooke & Plowr. in **14** (XII, 100, 1884); Sacc. *Addit. I–IV*, 207; **14** (XV, 3); *H. viscidula* Phill. & Plowr. in **14** (XIII, 79, 1885). On coniferous logs, Brandon, 1881.

— **gelatinosa** (Tode ex Fr.) Seaver. Petch **27** (LXXV, 229); **28** (XXI, 292); Cooke **15**, 774 as *Hypocrea*; Massee **14** (XV, 3); **37** (1909, 375); Plowr. Exs. I, No. 3; Vize Exs. 375; Berk. **20**, 238, 1836 as *Sphaeria*; *H. moriformis* Cooke & Massee in **14** (XVII, 3. 1888); Sacc. IX, 926; **18**A, 360. On wood.

[**Claviceps Junci** Adams in **48** (XVI, 168*, 1907), a *Sphacelia* stage only, on *Juncus*, Ireland.]

Claviceps nigricans Tul. Cooke **15**, 773, 1871; Massee **14** (XV, 2); Petch **28** (XXI, 300). Sclerotium only known in Britain, on *Eleocharis*.

— **purpurea** (Fr.) Tul. Petch **28** (XXI, 299*); Cooke **15**, 772; **27** (XIII, 15); **14** (VI, 25); **5**, 223*; **23** (XIV, 558; XVIII, 762; XXXV, 301; XXXVI, 139); **35** (July 1935; 1937, 25); **56** (XXVII, p. cxcvii); **63** (2, X, 443*); **65** (V, 149; XII, 418; XXX, 338); **75** (XXXIV, 235; XXIX, 51; XXXIII, 204); **79** (VI, 27; XI, 44); **81**, 214; **89**, 235*; **97**, 135; **103** (IV, 421); **112**, 167*; *Cordyceps* Berk. in **31** (1856, 549, reported as sometimes associated with bunt in wheat); B. & Br. **19**, No. 828, 1859; **18**, 382; Currey **45** (XXI, t. 45); and many other reports; Cooke **15**, 772 as *Claviceps microcephala* Tul.; **65** (XII, 430); **81**, 238; B. & Br. **19**, No. 828, 1859, as *Cordyceps microcephala*. On grasses. Early references to the sclerotia are Baker **66** (XII, 208, reported in 1765) and **45** (XVIII, 449 and 475).

Cordyceps capitata (Holmsk. ex Fr.) Link. Petch **27** (LXXIII, 223); **28** (XXI, 296); **14** (XV, 2); **35** (1915, 223*; 1916, 77); **64** (XLVII, 14); Cooke **15**, 771 as *Torrubia*; **14** (VIII, 103); Berk. **20**, 233, 1836 as *Sphaeria*; Currey **45** (XXII, t. 45). On *Elaphomyces*.

— **entomorrhiza** (Dickson ex Fr.) Link. Petch **28** (XVII, 173; XXI, 297) finds that Dickson's original collection, *Sphaeria* Dickson in **44**, 22*, 1785, is the only known British collection. On larva of beetle.

— **Forquignoni** Quél. Petch **28** (XXI, 298 and XVII, 173); "*Hypocrea myrmecophila*" in **19**, No. 591, 1851; C. Rea **28** (IV, 314) as *Cordyceps myrmecophila*. On flies.

— **gracilis** (Greville?) Dur. & Mont. Petch **28** (XVII, 173; XXI, 297* with note that most British records of *C. entomorrhiza* belong here; see Tul. **114** (III, 15*)); F. A. Mason **35** (1935, 165*); *C. Mawlei* Westwood in **31** (1891, 553*); Massee **33** (IX, 38). On buried larvae of Lepidoptera. There seems to be doubt about the identity of *Xylaria gracilis* Grev. in **39**, t. 86, 1824.

— **militaris** (Linn. ex Fr.) Link. Petch **28** (XXI, 296; XX, 216; XVII, 172); **18**, 282*; **33** (IX, 30); **65** (XXXI, 521); Ramsbottom, *Handbook of the Larger British Fungi*, p. 192*; Bolton **111**, t. 128, 1789 as *Sphaeria*; Purton **55**, t. 23; Sowerby **42**, t. 60, 1796; Berk. **20**, 232; Currey **45** (XXII, 262*); *Torrubia* Tul. in **114** (III, 5, 1865); Cooke **15**, 770*; Plowr. Exs. III, No. 1. On larvae and pupae of Lepidoptera.

— **ophioglossoides** (Ehrh. ex Fr.) Link. Petch **28** (XXI, 295); **27** (LXXIII, 224); Berk. **31** (1860, 792*); **81**, 61*; **33** (XV, 521); **64** (XLVII, 14); **65** (XXXII, 243 and 380); Bolton **111**, t. 128, 1791 as *Sphaeria*; Sowerby **42**, t. 60, 1796; Berk. **20**, 233; **19**, No. 92*, 1838; Currey **45** (XXII, 263*); *Torrubia* Tul. in **114** (III, 20); Cooke **15**, 771; Vize Exs. 477; Plowr. Exs. I, No. 1. On *Elaphomyces*.

Cordyceps sphecocephala (Klotz. ex Berk.) Berk. & Curt. in **36** (1867, 376, by a slip as "*sphecophila*"); Sacc. II, 567; Petch **28** (XXI, 297; XVII, 173); **14** (XV, 2); *Sphaeria* Klotz. ex Berk. in **21** (II, 206, 1843); *Torrubia* Tul. in **114**. On Hymenoptera.

[— **sphingum** (Tul.) Sacc. Phill. & Plowr. **14** (VI, 126, 1878); Massee **14** (XV, 2); **33** (IX, 34). "Conidia on moths."]

Epichloe typhina (Pers. ex Fr.) Tul. Petch **28** (XXI, 294*); Cooke **15**, 773*, 1871; **89**, 242*; Massee **14** (XV, 2); **5B**, 125*; **5**, 224*; Kathleen Sampson **28** (XVII, 30*, systemic infection); **112**, 166; **79** (III, 24; V, 29; XI, 44); **80**, 47; Vize Exs. 92; Cooke Exs. 186 and II, No. 233; Hooker **92**, 6, 1821 as *Sphaeria*; Berk. **20**, 285; Currey **45** (XXII, 265); *Hypocrea* Berk. in **18**, 383; **31** (1856 517) as *Dothidea*; *Stromatosphaeria* Greville in **39**, t. 204, 1826; *Sphaeria spiculifera* Sowerby in **42**, t. 274, 1800. On living stems of grasses.

Hypocrea argillacea Phill. & Plowr. in **14** (XIII, 79, 1885); Sacc. *Addit. I–IV*, 207; Petch **28** (XXI, 291); **14** (XV, 3); **18A**, 360. On wood.

— **citrina** (Pers. ex Fr.) Fr. Petch **28** (XXI, 292); Cooke **15**, 775; **14** (XV, 3); Greville **39**, t. 215, 1826 as *Sphaeria*; Berk. **20**, 238; Currey **45** (XXII, t. 46). On wood, earth, etc.

[— **lactea** (Fr.) Fr. Petch **27** (LXXV, 218) and **28** (XXI, 292) finds British specimens so recorded to be misidentified. Reported **14** (X, 70; XV, 3); **28** (III, 380); **18A**, 360.]

— **lutea** (Tode ex Fr. as var.) Petch in **27** (LXXV, 231, 1937); **28** (XXI, 291). Petch raises *Sphaeria gelatinosa* var. *lutea* Tode to specific rank and records specimens of Currey **45** (XXII, 265, 1858) and one of Hawley. On leaves.

— **placentula** Grove in **27** (XXIII, 133*, 1885); Sacc. *Addit. I–IV*, 207; Petch **28** (XXI, 292). On *Juncus*, Warwicks.

— **pulvinata** Fuckel. Petch **28** (XXI, 289); **27** (LXXIII, 189); **28** (III, 380); Phill. & Plowr. **14** (VIII, 104, 1880) as *H. citrina* f. *fungicola*; **14** (XV, 3) as *H. fungicola*. On *Polyporus betulinus* and other species. See Weese in *Mitt. Bot. Lab. Hochsch. Wien*, IV, 31, 1927.

— **rufa** (Pers. ex Fr.) Fr. Petch **28** (XXI, 290*); Tul. **114** (III, 30); Berk. **18**, 383; Cooke **15**, 774*; **14** (XV, 3); **46** (VI, 194); Berk. **20**, 238, 1836 as *Sphaeria*; Currey **45** (XXII, 266*). On wood, etc.

— **Schweinitzii** (Fr.) Sacc. Petch **28** (XXI, 290); **27** (LXIII, 190; LXXV, 217); B. & Br. **19**, No. 1395*, 1873 as *H. lenta*; Phill. & Plowr. **14** (IV, 123, 1876) as *H. contorta*; **14** (VII, 77; XV, 3); **18A**, 361; Phill. & Plowr. **14** (VIII, 104, 1880) as *H. rigens*. On wood.

— **splendens** Phill. & Plowr. in **14** (XIII, 79, 1885); Sacc. *Addit. I–IV*, 206; Petch **28** (XXI, 290); **14** (XV, 3). On *Laurus*.

— **strobilina** Phill. & Plowr. in **14** (XIII, 79, 1885); Sacc. *Addit. I–IV*, 206; Petch **28** (XXI, 292); **14** (XV, 3). "On cones of spruce. No specimens available."

— **tremelloides** (Schum. ex Fr.) Fr. Phill. & Plowr. **14** (VIII, 104, 1880); **18A**, 359; **14** (XV, 3). On wood.

Hypocreopsis lichenoides (Tode ex Fr.) Seaver. Petch **28** (XXI, 288*, 1938); *Sphaeria riccioidea* Bolton in **111**, t. 182, 1791; Berk. **19**, No. 95, 1838; *Hypocrea riccioidea* Berk. in **18**, 363, 1860; Cooke **15**, 774; **40** (IV, 304); **14** (VIII, 9; XV, 4); **7**, 211; *Hypocreopsis riccioidea* Karst. in *Myc. Fenn.* 251, 1873; Crossland **35** (1908, 371*); B. & Br. **19**, No. 1831, 1879 as *Hypocrea parmelioides*; **13**, 358. On *Salix*. Fries included both *Acrospermum lichenoides* Tode and *S. riccioidea* as lichens.

Oomyces carneo-albus (Lib.) Berk. & Br. gen.nov. in **19**, No. 590, 1851; Sacc. II, 564; Petch **28** (XXI, 294*); **27** (LXXV, 217); Cooke **15**, 780*; **14** (XV, 7); Tul. **114** (II, 257). On *Aira*.

Ophiocordyceps clavulata (Schwein.) Petch in **28** (XVIII, 53, 1933); **28** (XXI, 299*); Massee **33** (IX, 22) as *Cordyceps*; **28** (XVII, 173); *C. pistillariiformis* B. & Br. in **19**, No. 969*, 1861; *Torrubia pistillariiformis* Cooke in **15**, 771, 1871; **14** (VII, 77). On *Lecanium*.

Podostroma alutaceum (Pers. ex Fr.) Atkinson. Petch **28** (xxi, 289*); Berk. **20**, 235, 1836 as *Sphaeria*; Currey **45** (xxii, 264); B. & Br. **19**, No. 827, 1859 as *Cordyceps* [comb.n.?]; **18**, 382; Cooke **15**, 775 as *Hypocrea*; **14** (viii, 104; xv, 3); **27** (xliii, 320); Ramsbottom, *Handbook of the Larger British Fungi*, p. 193*; Plowr. Exs. ii, No. 3; *S. clavata* Sowerby in **42**, t. 159, 1798. Amongst conifers.

Polystigma fulvum (DC. ex Fr.) Chev. Cooke **15**, 804; Massee **14** (xv, 4); Cooke Exs. ii, No. 578; Berk. **20**, 286, 1836 as *Dothidea*; **18**, 391; Cooke Exs. 464; Petch **28** (xxi, 287) as *P. ochraceum*. On leaves of *Prunus Padus*. Fries accepted the epithet "*fulvum*", but placed it in *Dothidea*; Chevallier in 1826 seems to have been the first after Fries to use again the genus *Polystigma* DC.

— **rubrum** (Pers. ex Fr.) Chev. Petch **28** (xxi, 286*); Cooke **15**, 803*; Stevenson **13**, 364; Grove **68** (xxiv, 328); **5B**, 135*; **33** (xxvi, 761, life history); **53** (lvi, 507); **56** (xxvii, 939); **89**, 127*; **112**, 166; Cooke Exs. 182 and ii, No. 577; Baxter Exs. 32; Plowr. Exs. ii, No. 15; Hooker **92**, 9, 1821 as *Xyloma*; Purton **55**, 316*, 1821; Greville **39**, t. 120, 1824; *Dothidea* Fr. in *Systema*; Berk. **20**, 286, 1836. On leaves of *Prunus spinosa* and *P. insititia*.

Selinia pulchra (Wint.) Sacc. Petch **28** (xxi, 287*); **35** (1937, 283); Phill. & Plowr. **14** (iv, 123, 1876) as *Hypocreopsis*; Plowr. Exs. ii, No. 100; *Hypocrea* Cooke & Plowr. in **14** (vii, 78); **14** (xv, 4). On dung of sheep. Karsten proposed the genus *Selinia*, but did not make the combination.

LOPHIOSTOMATACEAE

Lophidium compressum (Pers. ex Fr.) Sacc. Massee **14** (xvii, 58); Hawley **35** (1913, 341); Bucknall **46** (v, 52, 1886) as *Lophiostoma*; Phill. & Plowr. **14** (viii, 107, 1880) as *Lophiostoma angustatum*. On *Salix*.

Lophiella cristata ([Pers.]) Sacc. Massee **14** (xvii, 57, 1889) as *Lophiostoma*. On branches.

Lophiosphaera pulveracea (Sacc.) Sacc. Bucknall **46** (v, 48* and 52, 1886) as *Lophiostoma*. Pill, near Bristol. Host not cited.

Lophiostoma Arundinis (Fr.) Ces. & de Not. Cooke **15**, 852; **65** (ix, 332*, 1868); **46** (v, 52); **14** (xvii, 58); Vize Exs. 490; Plowr. Exs. i, No. 60; Berk. **19**, No. 27, 1837 as *Sphaeria*; Currey **45** (xxii, 330*); Berk. Exs. 87. "On reeds and grasses."

— **Arundinis** var. **Tritici** B. & Br. in **19**, No. 639, 1852. On *Triticum*. King's Cliffe.

— **balsamianum** (Ces. & de Not.) Sacc. & Berl. See *L. excipuliforme* below.

— **bicuspidatum** Cooke in **65** (ix, 328*, 1868); **15**, 848; Bucknall **46** (ii, 349); **14** (xvii, 58); Cooke Exs. 661. On twigs. See Grove **27** (1933, 286) and *L. simillimum*.

— **caulium** (Fr.) Ces. & de Not. Cooke **65** (ix, 331*, 1868); **15**, 851; **46** (v, 52); **35** (June 1894); **7**, 232; **14** (xvii, 58); B. & Br. **19**, No. 982, 1861 as *Sphaeria*. On *Epilobium*, etc.

— **excipuliforme** (Fr.) Ces. & de Not. Cooke **65** (ix, 330, 1868); **15**, 851; **14** (xv, 58); Berk. **20**, 266, 1836 as *Sphaeria*. On bark, etc. Also recorded by B. & Br. **19**, No. 880*, 1859 as *Sphaeria*, but Berlese **98** (i, 15) refers this record to *L. balsamianum*.

— **fibritectum** (Berk.) Ces. & de Not. in *Schema*, p. 46; Sacc. ii, 696; Cooke **65** (ix, 329); **15**, 850; **46** (v, 52); *Sphaeria* Berk. in **21** (1853, 43*); B. & Br. **19**, No. 777, 1854. On wood of *Larix*.

— **insidiosum** (Desm.) Ces. & de Not. Grove **27** (lxxi, 285*, 1933). On *Lavatera*, Guernsey.

— **macrostoma** (Tode ex Fr.) de Not. Cooke **65** (ix, 327*, 1868); **15**, 848; **13**, 383; B. & Br. **19**, No. 881, 1859 as *Sphaeria*; Currey **45** (xxii, 321*, 1859). On branches. Berlese **98** (i, 15) refers Currey's record to *L. excipuliforme*.

— **microstoma** Niessl. Listed by Corner **28** (xix, 284, 1935). Wicken Fen, Cambs.

Lophiostoma quadrinucleatum Karst. Phill. & Plowr. **14** (VIII, 107, 1880); **14** (XVII, 57). On *Rhamnus*, Norfolk.
— **simillimum** Karst. Cooke **65** (IX, 328, 1868) and **15**, 842 as *L. bicuspidatum* var., teste Berlese **98** (I, 12). On *Clematis*, Surrey. Grove **27** (1933, 286) thought Cooke's variety to be *L. insidiosum*.
— **Ulicis** Nits. Massee **37** (1909, 374). On *Ulex*, Kew.
— **vagans** Fabre. Bucknall **46** (v, 127* and 132, 1887). "On stick of mahogany", near Bristol.
— **viridarium** Cooke in **65** (IX, 328*, 1868); **15**, 849; **14** (XVII, 57); Sacc. II, 691. On *Acer*, Surrey. Berlese **98** (I, 10*) considers the later *L. Desmazierii* Sacc. & Speg. a synonym.
Lophiotrema angustilabrum (Berk. & Br.) Sacc. in *Mich.* I, 338; *Syll.* II, 687; Grove **60** (1886, 36) and **27** (XXIV, 133); *Sphaeria* B. & Br. in **19**, No. 881, 1859; *Lophiostoma* Cooke in **65** (IX, 330*, 1868); **15**, 850; **13**, 384; **46** (IV, 59); Plowr. Exs. II, No. 49; Vize Exs. 280; *Lophiosphaera* Cooke in **14** (XVII, 26); Massee **14** (XVII, 57). On branches. Berlese **98** (I, 6) thought this a synonym of *L. praemorsum*.
— **Curreyi** Sacc. in *Syll.* IX, 1078, 1891, based on the homonym *Lophiostoma hysterioides* Currey ex Cooke in **14** (XVIII, 74, 1890). On wood, Chislehurst.
— **Hederae** (Fuckel) Sacc. Boyd **28** (IV, 71); Cooke **14** (III, 67, 1874) as *Lophiostoma*; *Lophiosphaera* Cooke in **14** (XVII, 25); Massee **14** (XVII, 57). On *Hedera*.
— **nucula** (Fr.) Sacc. Berk. **20**, 266, 1836 as *Sphaeria*; Cooke **15**, 849 as *Lophiostoma* [where he states his reference **65** (IX, 329*, 1868) was to *L. gregarium* Fuckel. The latter is apparently not known in Britain]; Bucknall **46** (V, 52); *Lophiosphaera* Cooke in **14** (XVII, 25); Massee **14** (XVII, 57). On bark of *Quercus*.
— **praemorsum** (Lasch) Sacc. *Lophiosphaera* Cooke in **14** (XVII, 25); Massee **14** (XVII, 57); *Sphaeria Jerdoni* B. & Br. in **19**, No. 975*, 1861; *Lophiostoma Jerdoni* Cooke in **65** (IX, 331*, 1868); **15**, 851; **13**, 384; Berl. **98** (I, 6). On *Rubus*, etc. See *L. angustilabrum* and next two.
— **semiliberum** (Desm.) Sacc. B. & Br. **19**, No. 641, 1852 as *Sphaeria*; Cooke **65** (IX, 332, 1868) as *Lophiostoma*; **46** (VI, 194); **15**, 852; *Lophiosphaera* Cooke in **14** (XVII, 25); Massee **14** (XVII, 57). On grasses. Berlese **98** (I, 6) thought this and the next probably *L. praemorsum*.
— **sexnucleatum** (Cooke) Sacc. in *Syll.* II, 683; *Lophiostoma* Cooke in **65** (IX, 330*, 1868); **15**, 850; Bucknall **46** (V, 132); Plowr. Exs. II, No. 50; *Lophiosphaera* Cooke in **14** (XVII, 26); Massee **14** (XVII, 57). On *Urtica*. Grove **60** (1886, 35*) thought this the same as *L. angustilabrum*.
— **vagabundum** Sacc. Bucknall **46** (V, 48* and 52, 1886) as *Lophiostoma*. On *Spiraea* near Bristol.
Schizostoma montellicum Sacc. Bucknall **46** (V, 127* and 132, 1887) as *Lophiostoma* [comb.n.?]. Near Bristol, host not given.

DOTHIDEALES

DOTHIDEACEAE

The names are as cited by Theissen and Sydow **102** (1915, 147–746).

Apiospora Montagnei Sacc. Theiss. & Syd. p. 419; Bucknall **46** (V, 128* and 132, 1877) as *Sphaeria* [comb.n.?]. On "Pampas grass", near Bristol.
"**Dothidea Genistae** Wint." Massee **37** (1911, 376). On *Genista*, Kew. Massee probably meant "*D. tetraspora*".
— **tetraspora** Berk. & Br. in **19**, No. 899*, 1859; Sacc. II, 640; Cooke **15**, 807; Massee **14** (XV, 36). On stems of *Daphne* and *Ulex*. See *Anthostoma Plowrightii*.
Dothidella Agrostidis (Fuckel) Sacc. Grove **27** (1922, 176). On *Poa* and *Agrostis*. Theiss. & Syd. p. 418 exclude this from the Dothideales.

Dothidella Pelvetiae Sutherland in **28** (v, 154, 1915); Sacc. xxiv, 545. On *Pelvetia*, Orkney.

[— **ribesia** (Pers. ex Fr.) Theiss. & Syd., p. 309; Hooker **92,** 5, 1821 as *Sphaeria*; *Stromatosphaeria* Greville in **51,** 357, 1824; Berk. **20,** 285, 1836 as *Dothidea*; Cooke **15,** 807; Massee **14** (xv, 36); Berk. Exs. 91; Vize Exs. 278; Cooke Exs. II, No. 488; Plowr. Exs. I, No. 28; **23** (xiv, 680*) as *Plowrightia*; Ismé Hoggan **28** (xii, 27*, parasitism); **65** (xxx, 340); **79** (I, 30; v, 30; xi, 51 and 53); **112,** 169*. On *Ribes*. The accepted name is *Plowrightia ribesia*, q.v.]

— **Trifolii** Bayliss Elliott & Stansfield in **28** (ix, 227*, 1924); **112,** 170; **79** (iv, 28; v, 28; xi, 44); sterile and pycnidial specimens have been listed as follows: Berk. **20,** 257, 1836 as *Dothidea*; Cooke **15,** 805; **89,** 227*; Baxter Exs. 84; Vize Exs. 390; Plowr. Exs. II, No. 17; Massee **14** (xv, 36) as *Phyllachora*; Theiss. & Syd. p. 576. On *Trifolium*. See **100** (xxvii, 71) under *Cymadothea*.

Endodothella Junci (Fr.) Theiss. & Syd. p. 586; Berk. **20,** 256, 1836 as *Sphaeria*; Currey **45** (xxii, 284*); Cooke **15,** 806 as *Dothidea*; **46** (II, 349); Berk. Exs. 35; Vize Exs. 487; Plowr. Exs. I, No. 26; Cooke Exs. II, No. 243; Massee **46** (xv, 36) as *Phyllachora*. On *Juncus*.

Euryachora betulina (Fr.) Schroet. Theiss. & Syd. p. 365; **35** (1934, 349); Greville **39,** t. 200, 1826 as *Dothidea*; Cooke **15,** 805; B. & Br. **19,** No. 1493, 1875 and No. 1729, 1878; Massee **14** (xv, 36) as *Dothidella*; **89,** 215*. On leaves of *Betula*.

Homostegia Pelvetii (Hepp) Lindsay in **53** (xxiv, 450, 1867); Cooke **14** (xiii, 66); Sacc. ix, 1049; Theiss. & Syd. p. 607. On *Sticta*. Keissler **119,** 77 refers this to *Conida fuscopurpurea* Vouaux, a Discomycete.

— **Piggotii** (Berk. & Br.) Karst. in *Myc. Fenn.* II, 222, 1873; Theiss. & Syd. p. 603; Sacc. II, 649; Massee **14** (xv, 36); *Dothidea* B. & Br. in **19,** No. 660, 1852; Cooke **15,** 809; Plowr. Exs. II, No. 19. On *Parmelia*. See Keissler **119,** 300.—*Homostegia* Fuckel is based on this species, which Fuckel called *H. adusta*.

Phyllachora Angelicae (Fr.) Fuckel. Massee **14** (xv, 36); Phill. & Plowr. **14** (III, 126, 1875) as *Dothidea*. On *Angelica*. See *Stigmatea Ostruthii* below.

— **Caricis** (Fr.) Sacc. Massee **14** (xv, 36); B. & Br. **19,** No. 604, 1851 as *Sphaeria*; Cooke **15,** 806 as *Dothidea*; Bucknall **46** (iv, 59, spores "apparently becoming 3 or 4 septate"). On *Carex*.

— **graminis** (Pers. ex Fr.) Fuckel. Massee **14** (xv, 36); **112,** 170; Berk. **20,** 257, 1836 as *Sphaeria*; Currey **45** (xxii, 285*); Cooke **15,** 806 as *Dothidea*; Cooke Exs. 678 and II, Nos. 185, 580; Plowr. Exs. I, No. 27; Vize Exs. 93. On grasses. This name has been used in Britain in a collective sense; Theiss. & Syd. p. 436 give a revised and restricted diagnosis.

— **Heraclei** (Fr.) Fuckel. Massee **14** (xv, 36); Berk. **20,** 287, 1836 as *Dothidea*; Cooke **15,** 805; Vize Exs. 486. On *Heracleum*. Von Höhnel has transferred this species to *Carlia*; see Raabe **105** (1938, 50).

[— **Pastinacae** Rostr. Recorded **37** (1918, 17) as conidial.]

Plowrightia ribesia (Pers. ex Fr.) Sacc. References are listed under *Dothidella*.

— **virgultorum** (Fr.) Sacc. Massee **37** (1914, 322*); **5** (2nd Ed. p. 2 Appendix); **23** (xxi, 1165). On *Betula*. Theiss. & Syd. **102** (xiv, 451, 1916) make this the type of a new genus *Anisogramma* of the Melogrammataceae; see also **102** (xv, 275; xxxii, 441).

Rhopographus filicinus (Fr.) Fuckel. Theiss. & Syd. p. 425; Massee **14** (xv, 37); Grove **27** (1922, 144); Euphemia Barnett **28** (xvi, 85); Berk. **20,** 255, 1836 as *Sphaeria*; Berk. Exs. 33; Cooke **15,** 808 as *Dothidea*; Cooke, *Fern book for everybody*, p. 20*, 1867; **14** (II, 164); Cooke Exs. 244; Plowr. Exs. I, No. 30; Vize Exs. 489 as *Dothidea Pteridis*; Cooke Exs. II, No. 496. Common on *Pteridium*. See Von Höhnel **102** (1917, 321). A. Lorrain Smith in **28** (III, 115, 1909) named f. *macrospora* of *R. Pteridis*; Rilstone **27** (1935, 103).

Scirrhia rimosa (Alb. & Schw. ex Fr.) Fuckel. Theiss. & Syd. p. 414; Massee **14** (xv, 37); Phill. & Plowr. **14** (viii, 106, 1880) as *Dothidea*; Massee **14** (xv, 37) as *S. depauperata*. On *Phragmites*.

Scirrhiachora Groveana (Sacc.) Theiss. & Syd. gen.nov. in **102** (XIII, 626); *Scirrhia* Sacc. in *Atti R. Istit. Ven.* 6 ser. III, 23*, 1885; *Syll.* IX, 1040; Grove **27** (XXIII, 133, 1885). On *Typha* near Birmingham.

Septomazzantia epitypha (Cooke) Theiss. & Syd. gen.nov. in **102** (XIII, 193); *Dothidea* Cooke in **14** (VII, 79, 1879); *Phyllachora* Sacc. in *Syll.* II, 605; **54** (III, 753). On *Typha*, Norfolk.

Systremma Frangulae (Fuckel) Theiss. & Syd., p. 335; Phill. & Plowr. **14** (VIII, 106, 1880) as *Dothidea*; **14** (XV, 36). On *Rhamnus*, Shrewsbury.

— **natans** (Tode ex Fr.) Theiss. & Syd. p. 330; Cooke & Plowr. **14** (VII, 79, 1879) as *Dothidea Sambuci* (Pers.) Fr.; **13**, 365; **14** (XV, 36). On *Sambucus*.

— **Ulmi** (Duval ex Fr.) Theiss. & Syd. p. 334; Greville **39**, t. 200, 1826 as *Dothidea*; Berk. **20**, 286; Tul **114** (II, 71); Cooke **15**, 804; Berk. Exs. 192; Cooke Exs. 184 and II, No. 579; Plowr Exs. I, No. 25; Vize Exs. 277; Massee **14** (XV, 35) as *Phyllachora*; *Sphaeria ulmaria* Sowerby in **42**, t. 374, 1802. Common on leaves of *Ulmus*.

MYRIANGIACEAE

Bagnisiella Rhamni (Mont. ex Cooke) Berl. & Vogl. in Sacc. *Addit. I–IV*, 233; *Dothidea* Mont. ex Cooke in **14** (XIII, 66, 1885); Massee **14** (XV, 36). On *Rhamnus*. *Bagnisiella* is considered to belong to the Myriangiaceae; Theiss. & Syd. **102** (1915, 295) did not see the type of *B. Rhamni* but from the description thought it belonged to the Dothideaceae, where they placed it, with doubt, in their genus *Bagnisiopsis*.

Dothiora Aucupariae (A. L. Smith) Theiss & Syd. in **102** (XIII, 659, 1915); *Curreyella* A. L. Smith in **28** (III, 43, 1908); Sacc. XXII, 441. On *Pyrus Aucuparia*, Scotland.

[— **pyrenophora** (Fr.) Fr. Cooke **15**, 429; Berk. **19**, No. 199, 1841 as *Dothidea*; Berk. Exs. 282. On *Pyrus*. Berkeley interpreted the *Macrophoma* state of a *Diplodia* as ascosporous. Berkeley's fungus appears in *Syll.* III, 380 as "*Botryodiplodia pyrenophora* (Berk.) Sacc."]

[— **sphaeroides** (Pers. ex Fr.) Fr. Cooke **15**, 429; Berk. **19**, No. 198, 1841 as *Dothidea*; **46** (III, 65); Vize Exs. 106. On *Fraxinus*. As with the preceding entry, Berkeley's record was based on a mistake. See Grove **1** (II, 69) as *Botryodiplodia Fraxini* Sacc.]

[**Elsinoe ampelina** Shear. On *Vitis*. British records, so far as noted, are to the conidial stage *Sphaceloma ampelinum* de Bary (teste Grove = *Gloeosporium ampelophagum* (Pass.) Sacc.). The references to *Guignardia Bidwellii* in Sphaeriaceae-Hyalosporae probably refer to the same conidial state.]

Elsinoe veneta (Burkh.) Jenkins. Beaumont **79** (XI, 37 and 51, 1934); **93**, 159; **1** (II, 225); Harris **77** (1925, 81, 1927) as *Plectodiscella*, ascus and conidial stages; **77** (1928–30, II, 134; 1932, 86; 1933, 145); **71** (XL, 52); **104** (IX, 73); **112**, 121*. On *Rubus*.

Myriangium Duriaei Mont. & Berk. in **21** (1845, 73). Petch **28** (VII, 33, 1921; X, 66; XVII, 174) gives numerous British records on insects, especially on *Chionaspis* on *Fraxinus*.

MICROTHYRIALES

POLYSTOMELLACEAE

[**Diplocarpon Rosae** Wolf. Conidia only known in Britain; **23** (XXIX, 1153; XXXIX, 400); **79** (V, 31; XI, 58); **56** (1931, 18; 1932, 58); **93**, 199; **112**, 113.]

Stigmatea Aegopodii (Pers. ex Fr.) Oudem. Massee **14** (XV, 38, 1886); Cooke **15**, 805, 1871 as *Dothidea Podagrariae*; Vize Exs. 94; Plowr. Exs. II, No. 16. On *Aegopodium Podagraria*. Von Hohnel has transferred this to *Carlia*. See also **102** (1910, 46; 1915, 575).

Stigmatea conferta (Fr.) Fr. Cooke **15**, 928; **13**, 367; Berk. **19**, No. 177 as *Sphaeria*. On *Vaccinium*. A doubtful species.

— **Geranii** (Fr.) Fr. Cooke **15**, 928; Massee **14** (xv, 38); Cooke Exs. 465 and II, No. 586; Vize Exs. 200; Greville **51**, 368, 1824 as *Xyloma*; Berk. **20**, 287 as *Dothidea*. On *Geranium*.

— **Nicholsoni** Cooke in **14** (XI, 16, 1882); Sacc. II, XLIII and IX, 660; **14** (XV, 38). On *Laurus*, Ireland.

— **Ostruthii** (Fr.) Oudem. Massee **14** (xv, 38); Berk. **19**, No. 102, 1838 as *Sphaeria*; Cooke **27** (IV, 251); Berk. Exs. 330; Cooke **15**, 922 as *Sphaerella* [comb.n.?]; Cooke Exs. 171 and II, No. 584; Plowr. Exs. III, No. 93; Vize Exs. 95. On *Angelica*. This name and *Phyllachora Angelicae* perhaps refer to the same doubtful species.

— **Pelvetiae** Sutherland in **32** (XIV, 37*, 1915); Sacc. XXIV, 395. On *Pelvetia*, Scotland.

— **Polygonorum** (Fr.) Fr. Cooke **15**, 929, 1871; **7**, 221. On *Polygonum*.

— **Ranunculi** Fr. Cooke **15**, 928, 1871; **46** (II, 350); **14** (XV, 38); Plowr. Exs. II, No. 97; Berk. **20**, 287 as *Dothidea*. On *Ranunculus*.

— **Robertiani** (Fr.) Fr. Cooke **15**, 928*; **14** (xv, 38); Vize Exs. 198; Cooke Exs. 283 and II, No. 585; Plowr. Exs. I, No. 98; Greville **39**, t. 146, 1825 as *Dothidea*; Berk. **20**, 288; Baxter Exs. 78; *Cryptosphaeria nitida* Greville in **51**, 363, 1824. On *Geranium Robertianum*.

MICROTHYRIACEAE

Asterina Veronicae (Lib.) Cooke in **14** (v, 122, 1877); **13**, 356; **70** (XXI, 397); *Capnodium sphaericum* Cooke in **15**, 934, 1871; Bucknall **46** (II, 218); **7**, 241. On leaves of *Veronica*. This is *Dimerosporium Veronicae* (Lib.) Arnaud, = *D. abjectum* (Lib.) Fuckel, the type species of *Dimerosporium*.

Microthyrium gramineum Bomm. Rouss. & Sacc. var. **major** Grove in **27** (LXXI, 286, 1933). On *Ammophila*, Kent.

— **ilicinum** de Not. Grove **27** (LXVIII, 134, 1930). On leaves of *Quercus*, Worcs. (Sacc. II, 660 lists this species as *Myiocopron*.)

— **microscopicum** Desm. Cooke **15**, 927*, 1871; **13**, 356; Trail **40** (1889, 63); Cooke Exs. 282 and II, No. 297; Plowr. Exs. III, No. 88. "On leaves of evergreens such as box, oak, etc."

— **Rhodendri** Grove in **27** (LXXI, 287, 1933). On *Rhododendron*, Wales.

Myiocopron Heleocharidis Grove in **27** (LXVIII, 133, 1930). On *Eleocharis*, Staffs.

MICROPELTACEAE

Clypeolum juniperinum Grove in **27** (LXVIII, 134, 1930). On *Juniperus*, Scotland.

HYSTERIALES

A few references are given below to Darker, G. D. ("The Hypodermataceae of Conifers," *Contr. Arnold Arboretum*, 1932), to Tehon, L. R. ("A monographic rearrangement of Lophodermium," *Illinois Biol. Monog.* XIII, No. 4, 1935) and to Duby (*Mémoire sur la Tribu des Hysterinées*. Geneva, 1861). A few notes on British Hysteriaceae will be found also in **28** (VIII, 176) and **100** (XXIV, 304).

Acrospermum compressum Tode ex Fr. Greville **39**, t. 182, 1826; Berk. **20**, 221; Cooke **15**, 430*; **73** (III, 70*); **14** (xv, 9); **46** (III, 138); Berk. Exs. 270; Vize Exs. 107, 345; Purton **55**, t. 19 as *Clavaria*; *C. herbarum* Sowerby in **42**, t. 253, 1800. On dead herbs. *Acrospermum* has been placed in various groups of fungi.

— **graminum** Lib. Berk. **19**, No. 164, 1841; Cooke **15**, 430; **14** (xv, 9); **7**, 369; Cooke Exs. II, No. 480. On dead grasses.

Actidium hysterioides Fr. B. & Br. **19,** No. 1092, 1865; Currey **45** (xxiv, 155); Cooke **15,** 766; **46** (v, 131); Massee **8** (iv, 30*). On chips, etc.

Aulographum maculare Berk. & Br. in **19,** No. 968*, 1861; Sacc. ii, 730; Cooke **15,** 765*; Massee **8** (iv, 32) found no fruit on the type specimen. On old herbs.

— **vagum** Desm. Cooke **15,** 765, 1871; **14** (ii, 165); Massee **8** (iv, 31*); **7,** 242; Cooke Exs. 695 and ii, No. 296. On dry leaves of *Hedera*, etc.

Dichaena faginea (Pers. ex Fr.) Fr. Massee **8** (iv, 45); **7,** 244; Cooke Exs. ii, No. 675; Cooke **15,** 932, 1871 as *D. rugosa*; **14** (iii, 45); Cooke Exs. ii, No. 464. On *Fagus*. Var. *corylea* Fr. and var. *capreae* Rehm are recorded by Massee, **8**.

— **quercina** (Pers. ex Fr.) Fr. Massee **8** (iv, 43*, 1895); **5,** 250; **7,** 224; Cooke **15,** 932, 1871 as *D. rugosa*; Cooke Exs. 697 and ii, No. 464. On *Quercus*.

— **strobilina** (Fr.) Fr. Cooke **15,** 932, 1871; Massee **8** (iv, 44); **7,** 244; Plowr. Exs. i, No. 100; Hooker **92,** 8, 1821 as *Sphaeria*; Berk. **20,** 271. On "fir cones".

Farlowiella Carmichaeliana (Berk.) Sacc. in *Syll.* ix, 1101; *Hysterium* Berk. in **20,** 294, 1836; **18,** 380; Cooke **15,** 760; **14** (xvii, 58); "*H. varium*" in **39,** t. 233, 1826. On smooth bark of *Quercus*, Appin.

— **repanda** (Bloxam ex Duby) Sacc. gen.nov. in *Syll.* ix, 1100; *Hysterium* Bloxam ex Duby in *Mém. Tribu Hyst.* p. 27*, 1861; B. & Br. **19,** No. 1181*, 1866; Cooke **15,** 758; Bucknall **46** (v, 50); *Farlowia* Sacc. in *Syll.* ii, 727; Massee **8** (iv, 24*). On wood.

Gloniopsis biformis (Fr.) Sacc. Listed by Rilstone **27** (1935, 104) as *Hysterographium*. On *Rhododendron*, Cornwall.

— **curvata** (Fr.?) Sacc. Massee **8** (iv, 42*); **7,** 244; **71** (xl, 51); B. & Br. **19,** No. 587, 1851 as *Hysterium*; **18,** 380; Cooke **15,** 759; Bucknall **46** (v, 131); Cooke Exs. 456 and ii, No. 199; Vize Exs. 267, 483. On *Rubus*, etc.

— **decipiens** de Not. A. Lorrain Smith **28** (iii, 282, 1911). On *Quercus*, Wales.

— **Muelleri** (Duby) Sacc. Rea & Hawley **71** (xxxi, Part 13, p. 15 and 26, 1912). Clare Island, host not given.

— **Vaccinii** (Carmichael ex Berk.) Boughey in **28** (xxii, 239*, 1939); *Hysterium* Carm. ex Berk. in **20,** 295, 1836). On *Vaccinium*, Appin.

Glonium amplum (Berk. & Br.) Duby in *Mém. Tribu Hyst.* p. 37, 1861; Sacc. ii, 737; Massee **8** (iv, 33); *Aulographum* B. & Br. in **19,** No. 782, 1854; *Hysterium* Cooke in **15,** 760. On *Rubus*.

— **lineare** (Fr.) de Not. Massee **8** (iv, 33); **7,** 242; Cooke Exs. ii, No. 457; Greville **39,** t. 167, 1825 as *Hysterium*; Berk. **20,** 294; Cooke **15,** 760. On wood. Petrak **102** (1923, 227) made this the type of *Psiloglonium*.

— **varium** (Fr.) Sacc. B. & Br. **19,** No. 1180*, 1866 as *Hysterium*; Cooke **15,** 758. On *Taxus*. Rehm (Rabenh. *Krypt.-Fl.* iii, 235) transferred this to *Tryblidiella*, a Discomycete.

Hypoderma brachysporum (Rostr.) Tubeuf. M. Wilson **28** (vii, 81, 1921). On leaves of *Pinus*, Scotland. Darker, p. 25, places this as a synonym of *H. Desmazierii*.

— **commune** (Fr.) Duby. Massee **8** (iv, 34); **7,** 242; B. & Br. **19,** No. 588, 1851 as *Hysterium*; **18,** 380; Cooke **15,** 761; Cooke Exs. 391. On herbaceous stems.

— **conigenum** (Pers. ex Fr.) Sacc.? Massee **8** (iv, 35); **7,** 243; Berk. **20,** 294, 1836 as *Hysterium*; **18,** 380; Cooke **15,** 762; **13,** 347. On "fir cones". Most or all of these records are doubtful: see Grove **1** (ii, 146) and von Hohnel, *Mitt. Bot. Inst. Tech. Hochs. Wien*, vi, 118.

— **Desmazierii** Duby. A. Lorrain Smith & Rea **28** (ii, 128, 1906); **28** (vi, 152); Grove **27** (lvi, 286); Darker p. 25. On needles of *Pinus*.

— **Hederae** ([Martius]) de Not. Massee **8** (iv, 33, 1895); Greville **39,** t. 129, 1825 as *Hysterium*; Berk. **20,** 294; Cooke **15,** 761; Bucknall **46** (ii, 217); Vize Exs. 381. On *Hedera*.

— **ilicinum** de Not. *Hysterium* Cooke in **15,** 760; Massee **8** (iv, 40) as var. of *Lophodermium maculare*; **7,** 243. On leaves of *Quercus*.

Hypoderma Laminariae Sutherland in **28** (v, 153, May 1915) and **32** (xiv, 190*, Aug. 1915); Sacc. xxiv, 1123. On *Laminaria*, Orkney.

— **scirpinum** (DC. ex Fr.) Duby? A. Lorrain Smith & Ramsbottom **28** (v, 424, 1917). On *Scirpus*, Scotland.

— **strobicola** Tubeuf. M. Wilson **64** (xxxiv, 223, 1920). On needles of *Pinus*, Scotland. Lind, *Danish Fungi*, and Darker, p. 25, consider this a synonym of *H. Desmazierii*.

— **virgultorum** DC. ex Sacc.? Massee **8** (iv, 35); **7**, 243; Greville **39**, t. 24, 1823 as *Hysterium*; Cooke **15**, 461; Cooke Exs. ii, No. 460 as var. *Rubi*; Berk. **20**, 295, 1836 as *Hysterium Rubi* Pers. On *Rubus*.

Hypodermella sulcigena (Rostrup) Tubeuf. Laing **64** (xliii, 52, 1929); M. Wilson **28** (vii, 79, 1921) as *Hypoderma pinicola* Brunch.; **64** (xxxiv, 222); Darker p. 56. On needles of *Pinus*, Scotland.

Hysterium angustatum (Alb. & Schw. ex Fr.) Chev. Hooker **92**, 8, 1821; Cooke **15**, 758; Bucknall **46** (iii, 68); Massee **8** (iv, 27); Cooke Exs. 579 and ii, No. 458. On wood. Fries (and Duby) placed this as a variety of *H. pulicare*. Fries was uncertain about *H. angustatum* Pers.

— **pulicare** Pers. ex Fr. Hooker **92**, 8, 1821; Greville **39**, t. 167, 1825; Berk. **20**, 293; Cooke **15**, 757; Massee **8** (iv, 26*); Cooke Exs. ii, No. 459. On wood. See **28** (viii, 176) for the early history of this name.

Hysterographium elongatum (Wahlenb. ex Fr.) Corda. Massee **8** (iv, 29); **7**, 245; Berk. **20**, 293, 1836 as *Hysterium*; Cooke **15**, 759; Bucknall **46** (ii, 216). On *Salix*, etc.

— **Fraxini** (Pers. ex Fr.) de Not. Massee **8** (iv, 29*); **7**, 245; Hooker **92**, 8, 1821 as *Hysterium*; Greville **39**, t. 72, 1824; Berk. **20**, 294; Cooke **15**, 789*; Baxter Exs. 33; Cooke Exs. 398 and ii, No. 198; Vize Exs. 258; *Sphaeria sulcata* Bolton in **111**, t. 124, 1789; Sowerby **42**, t. 315, 1801. On *Fraxinus*.

— **Rousselii** (de Not) Sacc. Massee **8** (iv, 28); Cooke **15**, 758, 1871 as *Hysterium*. On wood.

Lophium elatum Greville in **39**, t. 177, 1825; Sacc. ii, 800; Berk. **20**, 281; Cooke **15**, 766; **13**, 349; Massee **8** (iv, 37). On wood and bark.

— **mytilinum** (Pers. ex Fr.) Fr. Greville **39**, t. 177, 1825; Berk. **20**, 280; Cooke **15**, 766*; **46** (iii, 268); Massee **8** (iv, 36). On conifers.

Lophodermium arundinaceum (Schrad. ex Fr.) Chev. Darker p. 42; Massee **8** (iv, 38); **7**, 243; Berk. **20**, 295, 1856 as *Hysterium*; Cooke **15**, 763; Berk. Exs. 94; Cooke Exs. 294, 459. On "reeds".

— **caricinum** (Rob. in Desm.) Duby. Phill. & Plowr. **14** (xiii, 79, 1885). On *Carex*. Tehon p. 62 transfers it to his new genus *Dermascia*.

— **cladophilum** (Lév.) Rehm. Massee **8** (iv, 39); Grove **27** (1922, 86); Cooke **15**, 764 as *Sporomega*. On *Vaccinium*. See Boughey **28** (xxii, 239) for discussion of this species and *Hysterium Vaccinii* Carm. in Berk., and Grove **1** (ii, 175).

— **culmigenum** (Fr.) Karst. Berk. **20**, 296, 1836 as *Hysterium*; **18**, 380; Cooke **14** (iv, 68) as *H. arundinaceum* var. *culmigenum*; Cooke Exs. 459 and ii, No. 300. On grasses. Tehon p. 92 includes it as *Lophodermina culmigena* (Fr.) von Höhnel.

— **gramineum** (Fr.) Chev. Tehon p. 50; B. & Br. **19**, No. 1494, 1875 as *Hysterium arundinaceum* var. *gramineum*; Cooke **14** (iv, 68, 1875); **13**, 348. On grasses.

— **hysterioides** ([Pers.]) Sacc. Trail **40** (1889, 63); Massee **8** (iv, 40); **7**, 243; Berk. **20**, 296, 1836, p.p. as *Hysterium xylomoides*; Cooke **15**, 762; Berk. Exs. 196; ?Cooke Exs. 460. On leaves of *Crataegus*, *Berberis*, etc. Tehon p. 75 includes it as *Lophodermellina hysterioides* (Pers.) von Höhnel.

— **juniperinum** (Fr.) de Not. Massee **8** (iv, 41); Darker p. 66; **15**, 763 as *Hysterium*; Vize Exs. 383; Cooke Exs. 395; *Hysterium Juniperi* Greville in **39**, t. 26, 1823; Berk. **20**, 295 as *H. pinastri* var. *juniperinum*. On leaves of *Juniperus*. Tehon p. 96 transfers it to *Lophodermina*.

— **lineatum** A. L. Smith and Ramsb. in **28** (vi, 365, 1920); **48** (xxx, 37). On leaves of *Pinus*, Ireland. Darker p. 27 and Tehon p. 114 consider it to be *Hypoderma Desmazierii*.

Lophodermium macrosporum (Hartig) Rehm. Watson **64** (XXXI, 72, 1917); Darker p. 84; *Lophodermellina* Tehon in Monog. p. 76; Campbell & Vines **32** (XXXVII, 358*, 1938). On *Picea Abies*, Scotland.

— **maculare** (Fr.) de Not. Massee **8** (IV, 40); Greville **39**, t. 129, 1825 as *Hysterium*; Cooke **15**, 762; Berk. **20**, 296 as *H. foliicola* var. *maculare*; Berk. Exs. 95. On leaves of *Vaccinium*. Tehon p. 99 transfers it to *Lophodermina*.

— **melaleucum** (Fr.) de Not. Massee **8** (IV, 40); Grove **27** (1922, 86); Greville **39**, t. 88, 1824 as *Hysterium*; Berk. **20**, 295; Cooke **15**, 762. On leaves of *Vaccinium*. Von Hohnel transferred this to *Lophodermina*; see Tehon p. 100. Massee (**8**) records also a var. *pulchella*.

— **Neesii** Duby. Bucknall **46** (III, 267*, 1882) as *Hysterium* [comb.n.?]. On *Ilex* near Bristol.

— **Oxycocci** (Fr.) Karst. A. Lorrain Smith & Rea **14** (III, 39, 1908). On *Vaccinium*, Scotland.

— **pinastri** (Schrad. ex Fr.) Chev. Massee **8** (IV, 41); **5B**, 139*; **5**, 249*, Darker p. 69; **56** (1919, 313); **64** (XVII, 279 and 343; XLIX, 159); **65** (XXX, 348); **33** (XLIX, 699*, life history); **89**, 227*; **112**, 155; Hooker **92**, 8, 1821 as *Hysterium*; Greville **39**, t. 60, 1823; Berk. **20**, 295; Cooke **15**, 763; M. Ward **56** (XIV, 126, 1892); **23** (VII, 6); Vize Exs. 382; Cooke Exs. 396 and II, No. 662. On leaves of *Pinus*. Von Hohnel has transferred this to *Lophodermellina*; see Tehon p. 78.

— **Rhododendri** Ces. Roe **35** (1913, 218); Cooke **14** (III, 66, 1874) as *Hysterium sphaerioides* var. *Rhododendri*. On leaves of *Rhododendron*. Tehon p. 107 is uncertain about this name.

— **typhinum** (Fr.) Lambotte. Massee **8** (IV, 38); Tehon p. 59; B. & Br. **19**, No. 589, 1851 as *Hysterium*; Cooke **15**, 764. On *Typha*.

Mytilidion decipiens (Karst.) Sacc. Bucknall **46** (IV, 200, 1885) as *Lophium*. On *Pinus* near Bristol.

— **gemmigenum** Fuckel. Massee **8** (IV, 25, 1895); **7**, 244; *Lophium fusisporum* Cooke in **14** (IV, 114, 1876); **46** (IV, 59); Cooke Exs. 580 and II, No. 200; *Mytilidion fusisporum* Sacc. in *Syll.* II, 764; Cooke Exs. 580 and II, No. 200 as *Lophium mytilinum*. On coniferous wood.

— **laeviusculum** (Karst.) Sacc. Massee **8** (IV, 25*, 1895). On pine wood. Phill. & Plowr. record *Lophium laeviusculum* on "fir leaves", Scotland, in **14** (VIII, 103, 1880), apparently "forma *minor*....On pine leaves" of Massee.

Ostreion americanum Duby in Sacc. Recorded by Cooke **14** (XVI, 47, 1887); Massee **8** (IV, 28*); **7**, 245. On *Pinus*, Yorks. We found no specimen in Herb. Kew.

APPENDIX I

Pyrenomycetes recorded from Forays

The British Mycological Society has published (previous to 1939) lists of fungi reported on the forty autumn forays from 1897 to 1936 inclusive, and on twenty-four spring forays, 1909–15 and 1920–36. These lists include a total of 1880 records of 301 species and 4 varieties of Pyrenomycetes, listed under 322 specific names.

As no comprehensive work covering the distribution of British Pyrenomycetes has previously appeared, these foray lists furnish the only available information on the occurrence in Britain of the more abundant and conspicuous species. The records are set out in alphabetical order below.

In this list the names are given as cited in the foray records, but the name accepted in the List of Species, if differing, is indicated. The date of the earliest foray record is given first. This is followed either by the dates of later records (if few) or by their number (if many). Thus "*Valsa amoena* '08+3; S '12, '23" means that the species was first reported in the autumn foray of 1908, then in three subsequent

autumn forays, and in the spring forays of 1912 and 1923 (spring forays are marked "S"; spring and autumn foray records are separated by a semicolon).

Antennaria ericophila '09
Anthostoma melanotes '02, '30, *turgidum* S '23; '28, '29, '30
Anthostomella appendiculosa '20, '36
Apiocrea chrysosperma '35
Apiosporium [*Antennaria*] *pinophilum* '22
Arachniotus [*Gymnoascus*] *ruber* S '30
Asterina Veronicae '08
Aulographum vagum S '24

Berlesiella nigerrima '30; S '36
Bertia moriformis S '09+8; '13+8
Bombardia fasciculata '30
Botryosphaeria Dothidea '16, '30; S '34

Calonectria Plowrightiana [*C. ochraceo-pallida*] S '28
Calosphaeria dryina S '30, *pusilla* [*Wahlenbergii*] '27; S '29
Calospora alnicola S '15 (and S '30 as *Massarina*), *platanoides* S '23, '30; '27
Calyculosphaeria tristis S '33
Capnodium salicinum S '11, '32; '11, '12
Ceratostomella cirrhosa '02, '15, '20, [*Ophiostoma*] *pilifera* S '24, *rostrata* S '27, ?*vestita* S '33
Chaetomium bostrychodes '08, *elatum* '05+6; S '10+4
Chaetosphaeria phaeostroma '01+7; S '10, '11
Claviceps purpurea '12+10 (and as *microcephala* '05+14)
Cordyceps capitata '05+4, *Forquignoni* '24; S '32 (and S '13 as *myrmecophila*), *gracilis* S '32, *militaris* '05+18; S '11, *ophioglossoides* '00+13
Cryptosphaeria eunomia S '11+7; '11+5
Cryptospora Betulae '08, *corylina* '24; S '29, *suffusa* '08; S '15, '29
Cryptosporella compta '28
Ctenomyces serratus '26, '34; S '32, '33 (first '18 as *Arthroderma*)
Cucurbitaria Berberidis '08, '12, *Laburni* '12, '27, *Spartii* '12
Curreyella [*Dothiora*] *Aucupariae* '08

Daldinia concentrica '01+14; S '09+11, *vernicosa* '27
Delitschia minuta '20
Diaporthe Arctii S '28, *Aucubae* '25, [*Cryptodiaporthe*] *castanea* '28, *controversa* '22, '29, '30, *crustosa* '20, *decedens* '29, *decorticans* '20, *eres* '28, '34, '35; S '33, *fibrosa* '34, *inaequalis* S '30, *insignis* '18, *leiphaemia* '21+7; S '25+5, *longirostris* [*Cryptodiaporthe hystrix*] S '15, *Niesslii* S '28; '29, '30, *nucleata* '08; S '30, *occulta* S '23, *patria* [error for *D. impulsa*] S '30, *pulla* S '11; '11, '22, '28, '30, *revellens* '22, [*Gnomonia*] *rostellata* '15, '24, [*Cryptodiaporthe*] *salicella* S '24, *scobina* '30, *sorbicola* '22, *spina* [*Cryptodiaporthe salicella*] S '27, *strumella* '22, *taleola* '18+3; S '29, *Wibbei* [*Cryptodiaporthe Aubertii*] '12
Diatrype bullata '22, S '28, *disciformis* '07+20; S '09+12, *stigma* '02+27; S '09+21
Diatrypella favacea S '11, '29, '30; '11+3, *nigro-annulata* S '11, '23, '35; '11, *quercina* '07+21; S '09+18, *Tocciaeana* S '36, *verruciformis* '21+7; S '29+3
Dichaena faginea S '25+3; '28, var. *corylea* '22, *quercina* '05+6; S '09+7
Didymella applanata '32, *Salicis* S '25
Didymosphaeria fenestrans S '35
Ditopella ditopa S '30 (and as *fusispora* S '29)
Dothidea Sambuci [*Systremma natans*] '12, *tetraspora* '08; S '30
Dothidella [*Euryachora*] *betulina* S '09+3; '11+6, [*Systremma*] *Ulmi* S '12; '15+6

Endodothella Junci '08+11; S '10+14. Earlier records as *Phyllachora*
Epichloe typhina '01+5; S '09+9
Erysiphe Cichoracearum '08+16; S '15+3 (first '01 as *E. Montagnei*), *Galeopsidis* '15, '21; S '27, *graminis* S '09+11; '11+9, *Polygoni* '20+12; S '21, '25, '26 (first '08 as *E. Martii* and *E. Umbelliferarum*, 7 other records of these names), "*E. communis*", 6 records
Eutypa Acharii '98+3; S '28+2, *flavovirens* S '24, '29; '28, '29, (and as *flavovirescens* '17+3; S '25), *hydnoidea* '27; S '30, *lata* '08+11; S '09+10, *scabrosa* S '15, '30, *spinosa* '28; S '29, '33, '34
Eutypella prunastri S '30, *Sorbi* '30, *stellulata* '22+3 (and S '36 as *Valsa*)

Fenestella vestita S '23

Gibbera Vaccinii '27
Gibberella cyanogena S '26, *pulicaris* '08, '18, '34

Gloniopsis curvata S '12+4; '29, '34
Gnomonia cerastis S '25, [*veneta* S '26 (*conidial*)]
Guignardia punctoidea S '10; '10 (and as *Laestadia* S '11; '11)

Herpotrichia pinetorum '20
Hypocrea [*Podostroma*] *alutacea* '13, *citrina* '21, '26, [*Chromocrea*] *gelatinosa* '12+5, *rufa* '03+13; S '09, '10, *pulvinata* '27, '34; S '32, '36 (and as *H. fungicola*, '08, '20; S '12+4), *splendens* '98
Hypoderma conigenum '08+4, *Desmazierii* '05, *Rubi* [*virgultorum*] '20
Hypomyces aurantius '01+13; S '12+3, [*Hyphonectria*] *aureonitens* S '22, [*Byssonectria*] *lateritius* '17, *luteovirens* [*Apiocrea Tulasneana*] '22, *ochraceus* S '29, *rosellus* '05+14; S '09+9, *torminosus* [?*Byssonectria lateritia*] '05, '17, '19
Hyponectria Buxi '34 [and as *Sphaerella*, *q.v.*]
Hypospila pustula S '09+4; '11
Hypoxylon argillaceum '26, '34; S '29, *coccineum* '05+23; S '09+16, *cohaerens* S '33, *effusum* '04, *fuscum* '02+22; S '09+18, *multiforme* '06+19; S '09+14, *rubiginosum* S '12+5; '12+7 (and '28 and S '29 as *purpureum*), *rutilum* S '33, *semi-immersum* S '15+3; '22+6, *serpens* S '14+3; '21, '30, *udum* '02, '17
Hysterium angustatum S '11, '33; '11, '34, *pulicare* '22
Hysterographium Fraxini S '12, '13, '14; '20, '27, *Rousselii*, '02

Irene calostroma '36

Laestadia faginea '08, '12, *rhodorae* S '12
Lasiosphaeria hirsuta S '11, '33; '11+3. See *Leptospora* for others
Leptosphaeria acuta '07+5; S '09+19, *culmicola* S '14, *doliolum* '05, '07, '23; S '12, *Rusci* S '13, '21, '26; '28, *Typharum* '15, *vagabunda* S '11; '11, '17, '18
Leptospora ovina S '09+8; '10+11, *spermoides* '08+7, S '09+6, *strigosa* '11, '30; S '11 [all *Lasiosphaeria*]
Lophiotrema praemorsum S '30
Lophium mytilinum '20, '27
Lophodermium arundinaceum '12, *cladophilum* '08, '12, '20, *hysterioides* '36, *juniperinum* '08, '12, *pinastri* '08+7; S '12+3, *Rhododendri* '35

Massaria [*Massarina*] *eburnea* S '14, *inquinans* '08, *pupula* S '30
Melanconis Alni '12, '18, '27, *modonia* S '30, *stilbostoma* '08+17; S '11+8, *thelebola* S '15
Melanomma Aspergrenii S '11; '11, *fuscidulum* '20, '35; S '33, *pulvis-pyrius* '04+17; S '09+9. See also *Zignoella*
Melanospora parasitica '35
Melogramma spiniferum S '33
Microsphaera Alni '11, '24, '28; S '20 (and as *M. quercina* '25), *Berberidis* '12; S '34, *Euonymi* '11, '25, *Grossulariae* '08+8, *Mougeotii* '20
Mycosphaerella Ascophylli '13, *brassicicola* '16; S '26, '27, *carinthiaca* '31, *clymenia* '36, *depazeiformis* '31, '36, *Fragariae* '16+3, *hedericola* S '10+4; '10, *idaeina* '36, [*Didymellina*] *Iridis* '14, '25, *maculiformis* S '12+7; '20+2, *peregrina* '36, *Rumicis* (p.p. as *Venturia*) '08+11; S '11+5 (several p.p. as *Sphaerella*)
Myriangium Duriaei '20, '24
Mytilidion gemmigenum S '12

Naumovia abundans '31, '33
Nectria Aquifolii '98, '30, '34; S '36 (and S '99 as *N. inaurata*), *cinnabarina* '01+26; S '09+14 (and S '12 as *N. ochracea*), *coccinea* '02+15; S '09+9, *Coryli* S '30, *dacrymycella* [*Chromocrea cupularis*] '98, [*Dialonectria*] *Desmazierii* '34, *galligena* S '23+3; '35, *mammoidea* S '25, '30, '35; '35, [*Hyphonectria*] *muscivora* S '13, [*Dialonectria*] *Peziza* '06+5; S '21, '34, *punicea* '34 (and as *ditissima* '01, '10, '17; S '10, '22), *Ralfsii* '98, '35, [*Dialonectria*] *sanguinea* S '09, '25, '34; '14, '22, '30 (and as *N. episphaeria* S '09+14; '09+11), *sinopica* '28, '30, '35; S '35, [*Dialonectria*] *Veuillotiana* S '35
Niesslia exilis S '12
Nummularia Bulliardi '98, *lutea* '35

Ophiobolus acuminatus '11; S '11, '12, *Bardanae* S '35, *porphyrogonus* [*rubellus*] S '12+3; '14+5

Peroneutypa heteracantha S '28; '28, '29, '34
Philocopra collapsa S '30, [*Sordaria*] *curvicolla* S '30
Phyllachora Angelicae '12, '15, *graminis* '07+20; S '11+9, *Heraclei* '12, *Podagrariae* [*Stigmatea Aegopodii*] '08, '12, '27, [*Dothidella*] *Trifolii* '36

Phyllactinia corylea '24+6; S '26, '27 ('11+5 as *P. suffulta*)
Pleospora herbarum '11+5; S '11+4
Plowrightia ribesia '22; S '32
Podosphaera leucotricha '16, '20, '26; S '26, '27, '30, *Oxyacanthae* '08+15; S '15+4 (first as *P. myrtillina*), var. *tridactyla* '11, '12
Podospora coprophila '13, '20; S '21, *decipiens* '04, '08, *minuta* '05+3; S '30 [all cited above as *Sordaria*]
Poronia punctata '99
Pseudovalsa lanciformis '15+4; S '29, '30, '31

Quaternaria dissepta '28+3; S '35, *quaternata* '28, '35; S '30 (and as *Q. Persoonii* '99+3; S '09, '10, '36)

Rhopographus filicinus S '28+2; '28+4 (as *R. Pteridis* '05+13; S '09+7)
Rosellinia aquila '07+5; S '11+8, *Clavariae* [*Helminthosphaeria Clavariarum*] '02, '17, *ligniaria* S '30, *mammiformis* S '12; '20, '30, "*mammoidea*" '26, *pulveracea* S '12; '18, *velutina* '22

Scirrhia rimosa S '35
Sillia ferruginea '08+3
Sordaria caudata '27, *discospora* var. *major* [*Hypocopra scatigena*] '20, [*Hypocopra*] *fimicola* '06+4; S '21, var. *canina* '08, [*Hypocopra*] *maxima* '20
Sphaerella [*Hyponectria*] *Buxi* '10, '13; S '10, '13, *Elodes* '16, *Primulae* S '12, *Pteridis* S '21, *punctiformis* S '12; '20, *Vaccinii* '08, '12, '13 [last four now as *Mycosphaerella*]
Sphaerostilbe aurantiaca '29, '35
Sphaerotheca Humuli '11+14 (p.p. as *Castagnei*), *pannosa* S '09+10; '10+19, *tomentosa* [*Euphorbiae*] S '25; '36
Sphaerulina Taxi '31, '33
Sporormia ambigua '20, *fimetaria* S '21, *intermedia* '13, '18, '22; S '30, *minima* '04, '05, '08, '13
Stigmatea Ostruthii '15, *Robertiani* '08+10; S '14+13

Teichospora obducens '27 (and S '28 as *Strickeria*)
Tichothecium erraticum '22, *gemmiferum* '22
Trematosphaeria melina S '12
Trichosphaeria barbula '02; S '12, *minima* [*myriocarpa*] '30, '35, *pilosa* '01, '20; S '14

Uncinula Aceris '08+19; S '21, '26, '35, *adunca* [*Salicis*] '01
Ustulina vulgaris '01+24; S '09+16

Valsa ambiens '08+3; S '12, '23, *ceratophora* S '12; '15, '24, *cincta* S '30, *decorticans* '22, *diatrypa* S '36, *Fuckelii* '29, *populina* S '12+4, *salicina* S '30
Valsaria insitiva '20
Venturia inaequalis '21+3; S '33, *pirina* '18 conidial, '29

Xylaria bulbosa S '11; '11, *carpophila* S '09+5; '10+9, *Hypoxylon* '01+34; S '09+23, *longipes* '30, '35, *polymorpha* '07+11; S '13+7 (and var. *pistillaris* '16), *Tulasnei* '12, '34

Zignoella eutypoides '18, *ostioloidea* [*Trichosphaeria myriocarpa*] '20, *pulviscula* '12, '30; S '15, '36 (and S '12, '18, '20 as *Z. ovoidea*) (*Zignoella* entries p.p. as *Melanomma*)

APPENDIX II

Fungi Exsiccati published in Britain

During the years 1825–88 many fungi were issued in Britain as Exsiccati. The Pyrenomycetes included are cited by number in the List of Species unless references are given to publications which report study of Exsiccati. Thus the Erysiphaceae and many species of *Hypoxylon*, *Diaporthe* and Hypocreaceae are given without reference to British Exsiccati.

Some collections of British fungi were sent by Broome for inclusion in Exsiccati issued by Rabenhorst, and by Plowright for Thümen's Exsiccati. These records are included only in part.

"Baxter Exs."—Baxter, W. *Stirpes Cryptogamae Oxoniensis, or Dried specimens of Cryptogamous Plants collected in the vicinity of Oxford. By William Baxter.* Fasc. 1, Nos. 1–50. Oxford, 1825. Fasc. 2, Nos. 51–100. Oxford, 1828. The two Fascicles include some 23 Pyrenomycetes.

"Berk. Exs."—Berkeley, M. J. *British Fungi, consisting of dried specimens of the species described in Vol. V, pt. II of the English Flora, together with such as may be discovered indigenous to Britain. By the Rev. M. J. Berkeley, M.A.* Fasc. 1, Nos. 1–60, 1836. Fasc. 2, Nos. 61–120, 1836. Fasc. 3, Nos. 121–240, 1837. Fasc. 4, Nos. 241–350, 1843. About 70 Pyrenomycetes were included in the four Fascicles.

"Cooke Exs."—Cooke, M. C. *Fungi Britannici Exsiccati.* Centuries I–VI, London 1865–1871. These are quoted above as "Cooke Exs." Series II, Cent. I–VII, 1875–1879. Numbers in this Series are indicated in the List of Species as "Cooke Exs. II". A list of the species in Ser. I and the first five Centuries of Ser. II was published by Cooke in *Grevillea* V, 38–45, 65–73, 99–101. For Ser. II, Cent. VI see **14** (VI, 56–58, 1877) and for Cent. VII **14** (VIII, 21–23, 1879). About 500 of the 1300 numbers are Pyrenomycetes. We have not listed the 50 or more Erysiphaceae included.

"Plowr. Exs."—Plowright, C. B. *Sphaeriacei Britannici.* Fasc. I, Nos. 1–100, 1873. List in *Grevillea* II, 58–60, 1873. Fasc. II, Nos. 1–100, 1875. Fasc. III, Nos. 1–100, 1878. These 300 numbers are of much value to the student of Pyrenomycetes.

"Vize Exs." Vize, John E. *Micro-Fungi Britannici.* Cent. I, Nos. 1–100, 1878. Cent. II, Nos. 101–200, 1879. Cent. III, Nos. 201–300, 1880. Cent. IV, Nos. 301–400, 1882. Cent. V, Nos. 401–500, 1884. Cent. VI, Nos. 501–600, 1888. We have enumerated the 150 Pyrenomycetes (exclusive of Erysiphaceae) issued by Vize.

Vize, *Fungi Britannici*, Cent. I, 1873 and Cent. II, 1875. No Pyrenomycete except No. 100, *Chaetomium elatum*, and a few Erysiphaceae.

Phillips, W. *Elvellacei Britannici.* Cited below, No. 43. No Pyrenomycete.

["Bloxam, British Fungi". Mentioned by Cooke **14** (XV, 102), but evidently not effectively published.]

REFERENCES

The publications have been checked for the present list unless a note is given below to the contrary. Current periodicals were examined to the end of 1937, and many 1938 and some 1939 records are also included. Serial numbers not present in this list will be occupied in subsequent lists by works referring to other fungal groups.

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(2) REA, CARLETON (1922). *British Basidiomycetae.*

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(5) —— (1910). *Diseases of Cultivated Plants and Trees.*

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(13) STEVENSON, JOHN (1879). *Mycologica Scotica.* [Includes first publication of many of Cooke's suggested new combinations.]

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(17) Cooke, M. C. (1865). *Index Fungorum Britannicorum*. [A list of the names of the fungi recorded in the British Isles up to 1865.]

(18) Berkeley, M. J. (1860). *Outlines of British Fungology*. [Includes a few new combinations and a number of illustrations. Most species of microfungi are merely mentioned, and such have not been indexed above.]

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(35) *The Naturalist*, 1864–1937. [The volumes 1905–37 have been examined; references to preceding volumes are taken from Massee and Crossland, **7** and **7A**.]

(36) *Journal of the Linnean Society of London (Botany)*. i–li, 1857–1937.

(37) *Kew Bulletin*. 1887–1937 [one vol. per year].

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(43) Phillips, William. *Elvellacei Britannici*. Fasc. 1, Nos. 1–50, 1874, 2, Nos. 51–100, 1875, 3, Nos. 101–50, 1877, 4, Nos. 151–201 (plus 3), 1881.

(44) DICKSON, JAMES (1785–1801). *Fasciculi Plantarum Cryptogamicarum Britanniae.* [Four fascicles; includes figures and brief descriptions of a few Pyrenomycetes.]

(45) *Transactions Linnean Society.* I–XXX, 1791–1875; 2nd Ser. I–VIII, 1880–1922.

(46) *Proceedings Bristol Naturalists' Society.* Cited for papers by Cedric Bucknall in II–VI (new series), 1878–91. [Bucknall collected and reported many fungi. His own herbarium has been destroyed, but a number of specimens were sent by him to various other mycologists.]

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INDEX TO GENERA AND SPECIES

A numeral in italics refers to a name entered as a synonym or otherwise not accepted. The more complete citation of authors is given in the List of Species: here pre-Friesian authors are omitted, except for genera, names cited as synonyms, and for the Erysiphaceae.

A specific epithet is entered but once, under the generic name here accepted. Thus "Parmeliarum" is indexed only as Leptosphaeria although it has been placed in five other genera.

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THE BRITISH SPECIES OF *PUCCINIA* INCLUDED UNDER "*P. SYNGENESIARUM*" WITH NOTES UPON THE BRITISH RUST FUNGI OCCURRING ON THISTLES

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There has been considerable doubt regarding the identity of the rusts known by the older British mycologists as *Puccinia Syngenesiarum*.* Two authorities have been given for this species, Link and Corda.

(1) *P. Syngenesarum* Link in Linn. *Sp. Plant.* ed. IV, 6, (2), p. 74 (1825).

P. conglomerata Schmidt & Kunze, *exsicc.* n. 191.

Uredo conglomerata Strauss, *Wett. Ann.* 2. p. 100.

This is stated by Link to occur on *Tussilago alpina* Kunze and on *Centaurea alpina* Ehrenb. in Germany. These two hosts have been proved to be identical and are now called *Homogynes alpina*. The rust is known as *P. conglomerata* (Strauss) Kze. & Schm. It is a well-recognized species possessing teleutospores only, which are smooth, generally attenuated at base and apex, with the apex usually unthickened and with very short hyaline pedicels. A description with references to literature, iconography, synonymy and list of exsiccata is given by Sydow (1902, p. 99). *P. Senecionis* Lib. and *P. expansa* Link were at one time included in *P. conglomerata* but are now recognized as distinct species. There is no evidence that *P. conglomerata* as at present defined is a British species.

(2) *P. Syngenesarum* Corda, *Icones* IV, p. 16, Taf. IV, fig. 53 (1840). Corda adds "Link. *Spec.* II, p. 74, part", and states that the species occurs on *Cirsium lanceolatum*, *Onopordon Acanthium* and many other Synantherae.

He adds that the large, elongated, almost pulvinate and pulverulent sori reach often nearly a line in length and up to one-quarter of a line in width and that the surrounding leaf surface with its hair becomes powdered with the spores. The spores possess a very short, thin, colourless stalk which is often pointed. Corda gives two figures; one shows the leaf, apparently at natural size, with elongated sori about

* The specific epithet has been spelt in several ways: *Syngenesiarum*, *Syngenesarum* and *Syngenesearum*. The first method, from *Syngenesia* L., is regarded here as correct and is used in this note. In referring to special papers however or books the spelling used there is retained.

2–3 mm. long and 1 mm. wide; the second shows the teleutospores with wall of equal thickness all round, no papilla, very slight constriction, rounded above and below, colourless pedicel more or less pointed at the base and sometimes attached obliquely.

It is noteworthy that both *P. Syngenesarum* Link and *P. Syngenesarum* Corda agree in possessing smooth, slightly constricted teleutospores with the wall of equal thickness all round and very short hyaline pedicels.

The descriptions of *P. Syngenesiarum* given by Johnston (1831, p. 197), Berkeley (1836, p. 365) and Cooke (1871, p. 499; 1878, p. 206) are generally similar to the accounts given by Link and Corda. Johnston gives Link as the authority and states that the species occurs on the leaves of thistles and of the goat's-beard. Berkeley also gives Link as authority; he states that he has not seen the fungus on thistles and refers to Johnston. Cooke gives Link as the authority but also refers to Corda; he quotes *P. Cirsii* Fckl. as a synonym. He states that the species is common on thistles in autumn (1871, p. 499; 1878, p. 206). Plowright (1889) gives *P. Syngenesiarum* Link as a synonym for *P. Tragopogi* and quotes "Johnst. *Flor. Berw.* II, p. 197, in part".

Up to this stage all the authors agree in their publications that *P. Syngenesiarum* possesses teleutospores with very short pedicels. It may be assumed that this was the general opinion until the publication in 1889 of Plowright's *British Uredineae and Ustilagineae.*

When however the specimens of *P. Syngenesiarum* collected by Johnston, Vize and Cooke are examined, a different state of affairs is discovered. Eighteen specimens from the herbaria at Kew, Edinburgh, Birmingham (Plowright Herbarium and Grove Collection) and Berwick (Johnston) have been examined; these specimens were collected between 1831 and 1885. The oldest specimen examined,* that from Johnston's herbarium at Berwick, is found to be *P. Carduorum* Jacky, on *Carduus crispus* L. As *P. Carduorum* possesses small sori and the teleutospores have short hyaline pedicels it does generally agree with the description given for *P. Syngenesiarum.* Two of the specimens were collected by Vize; one is *P. Carduorum* on *Carduus nutans* L., and the second *P. Le Monnieriana* Maire on *Cnicus palustris* Willd. One specimen collected by Miss Jelly in 1878 is also *P. Le Monnieriana* on *C. palustris.* Of the fourteen specimens collected or named by Cooke, one is *P. Carduorum* on *Carduus crispus* and thirteen are *P. Le Monnieriana* on *C. palustris.*

In the majority of the specimens of *P. Syngenesiarum,* the name of the host plant is not given and, since most of the specimens consist of

* There is no date on Johnston's specimen in the herbarium at Berwick but as a reference is given on the sheet to his Flora it must have been placed in this collection subsequently to 1831. Johnston died in 1855 and thus the date of the specimen must be between 1831 and 1855.

isolated leaves or portions of leaves, it has been very difficult to determine the identity of the hosts. The differences between the leaves of *Cnicus lanceolatus* and *C. palustris* are, however, well marked. In *C. lanceolatus* stout spines are found on the margin of the leaf and similar spines of smaller size occur on the upper surface; a few white, cottony hairs are also found on the upper surface, especially along the midrib and veins and similar hairs are abundant on the lower surface. In *C. palustris*, spines are found only on the leaf margin; scattered, multicellular hairs, which have a glistening appearance in the dried specimen, are found scattered over both upper and under surfaces, especially near the veins; these somewhat resemble a string of beads in appearance, owing to the constrictions between the cells.

The teleutosori of *P. Le Monnieriana* are fairly large, the teleutospores are clavate with long, coloured, persistent pedicels and thus thirteen out of fourteen of Cooke's specimens do not agree with his description of *P. Syngenesiarum* (1878, p. 206) in which the sori are described as minute, the teleutospores having short pedicels.

It is interesting to note that in the packet containing one of Cooke's specimens there is a portion of a letter written by the correspondent who sent the specimen; the signature has been cut away. This correspondent writes: "What is this enclosed *Puccinia* on *Carduus*? It is unlike any of the described species on the Compositae as it has a very long peduncle." This specimen was, however, labelled *P. Syngenesiarum* by Cooke.

Cooke, in his general account of *P. Syngenesiarum* states (1878, p. 62): "No species in the entire genus makes so prominent an appearance as the one on the radical leaves of the spear thistle (*Carduus lanceolatus*). This latter plant is exceedingly abundant, and so is its parasite (*Puccinia syngenesiarum*, Lk.). From the month of July till the frosts set in we may be almost certain of finding specimens in any wood. The leaves have a paler roundish spot, from one-twelfth to one-fourth of an inch in diameter, on the upper surface, and a corresponding dark brown raised spot on the under surface, caused by an aggregation of pustules, forming a large compound pustule, often partly covered with the epidermis. The individual pustules are small, but this aggregate mode of growth gives the clusters great prominence, and therefore they are not easily overlooked (plate IV, fig. 63). Although not confined to this species of thistle, we have not yet found this *Puccinia* on any other plant. The spores are elliptical, rather elongated, constricted, and without spines (fig. 64)."

If, in this account, *Cnicus palustris* is substituted for *C. lanceolatus* as the name of the host, a very good description of *P. Le Monnieriana* is produced; the observation that the rust occurs on the radical leaves is particularly interesting, for this position is very characteristic of *P. Le Monnieriana* and has been specially noted by Maire (1913); the pale

roundish spot on the upper surface of the leaf opposite the hypophyllous sorus is also distinctive of this species. From a consideration of Cooke's account, together with the facts previously mentioned, it appears very probable that his identification of the host was incorrect and that the plant in question was *Cnicus palustris*, not *C. lanceolatus*. Additional evidence for this conclusion is given by an examination of his fig. 63, Pl. IV, in which a portion of the leaf, bearing sori is shown; the leaf depicted agrees better with *C. palustris* than with *C. lanceolatus* and the sori closely resemble those of *P. Le Monnieriana*. Also it may be noted that *C. lanceolatus* does not commonly grow in woods while *C. palustris* is often found in open places in damp woods. Cooke's fig. 64, Pl. IV depicts two teleutospores; these, as they are hardly clavate and have short colourless pedicels and no apical thickening, do not agree with those of *P. Le Monnieriana* but more nearly with the description of *P. Syngenesiarum*.

During August 1939 plants of *Cnicus palustris* were collected in Wyre Forest, Worcestershire, in which the radical leaves were infected with *P. Le Monnieriana* and the cauline leaves with *P. Cirsii*. Cooke may have collected similarly infected plants and drawn the sori from a radical leaf, and the teleutospores from a cauline leaf; or his drawing of the teleutospores may have been influenced by his description of *P. Syngenesiarum* (1878, p. 206).

Knowing that Cooke's *P. Syngenesiarum* consisted almost entirely of *P. Le Monnieriana* on *Cnicus palustris* it is easy to trace the influence of his mistakes on subsequent investigators. These latter appear to have based their work on the assumption that *P. Syngenesiarum* of Cooke consisted for the most part of a rust growing on *Cnicus lanceolatus* in which the teleutospores possessed an upper cell with the wall thickened at the apex and long, persistent, coloured pedicels.

Plowright (1889, p. 216) described a new species *P. Cardui* on *Cnicus lanceolatus* and *Carduus crispus*, of which the description agrees almost exactly with that of *P. Le Monnieriana* Maire. This is stated to grow on *Cnicus lanceolatus* and *Carduus crispus*. He gave as synonyms:

> *Puccinia Syngenesiarum*, Link. Johnst. *Flor. Berw.* II, p. 197; Berk. *Eng. Flor.* v, p. 365; Cooke, *Hdbk.* p. 499; *Micro. Fungi*, 4th ed. p. 206, t. IV, figs. 63, 64;
>
> *Puccinia Cirsii* Fckl. Exs. No. 340 (?);

but stated "It is clearly not the plant described by Link (*Sp. Plant.* VI, pt. II, p. 74) which has very short pedicels. It may be Fuckel's *P. Cirsii*." Plowright thus clearly indicated that although his species was not *P. Syngenesiarum* Link it was the *P. Syngenesiarum* of Cooke and others. Up to the present, endeavours to obtain Plowright's type specimen have failed. Specimens of *P. Cardui* Plowr. have, however, been examined from Kew and Birmingham. That from Kew is labelled "Herb. C. Crossland, on *Carduus* sp.? Isle of Wight, per J. F

Rayner, Southampton, Aug. 29/07." It is *P. Le Monnieriana* on *Cnicus palustris*. Two specimens from Birmingham labelled "*Puccinia Cardui* on *Cnicus lanceolatus*, Randan Woods" (one in the handwriting of W. B. Grove), are also *P. Le Monnieriana* on *Cnicus palustris*. It appears, therefore, that both Plowright and Grove followed Cooke in their incorrect determination of the host plant; possibly they accepted Cooke's statements and specimens without further investigation.

Sydow (1902, p. 58) quoted *P. Cardui* as a synonym for *P. Cnici-oleracei* Pers. and stated that this rust is found on *Cirsium lanceolatus* and *Carduus crispus* (?) as well as on *Cirsium ochroleucum* and *C. oleraceum*, apparently relying on Plowright's statements for the two former species. Fischer (1904, p. 292) stated that *P. Cnici-oleracei* occurs on *Cirsium ochroleucum*, *C. oleraceum*, *C. lanceolatum* and *Carduus crispus* "(nach P. und H. Sydow)", but records it in Switzerland only on *Cirsium oleraceum*.

Grove (1913, p. 144) under his description of *P. Cnici-oleracei* Pers. states that "It is doubtful if *Puccinia Syngenesiarum* (Cooke, *Handbook*, p. 499; *Micro. Fung.* p. 206) belongs entirely here, as the figure in the latter work (Pl. IV, fig. 64) does not give the true form of the teleutospore; but the majority of the specimens issued by him under that name are this species." Grove quotes *P. Cardui* Plowr. as a synonym for *P. Cnici-oleracei* Pers., and gives as host plants *Cnicus lanceolatus* and, doubtfully, *Carduus crispus*. This is not surprising, for there is a great resemblance between *P. Cnici-oleracei* and *P. Le Monnieriana* and, as already shown, it is highly probable that *P. Cardui* Plowr. is identical with *P. Le Monnieriana*.

It may be concluded therefore that Cooke's misstatements, made between 1864 and 1885, and his incorrectly determined specimens, strongly influenced investigators during the subsequent thirty-five years and at length led to the erroneous statements made by Grove in connexion with *P. Cnici-oleracei*. No British specimens labelled *P. Cnici-oleracei* have been found in the herbaria at Kew, Edinburgh, Birmingham or Berwick; Ramsbottom (1913) includes this species in his list of British Uredinales but gives *P. Cardui* Plowr. as a synonym.

Liro (1908, p. 396) has stated that in Finland, *P. Cnici-oleracei* occurs on *Cnicus heterophyllus* Willd., *C. oleraceus* and the hybrid *C. oleraceus* × *heterophyllus*, and that the rust on these three hosts is identical with *P. Andersoni* B. & Br. Sydow (1904, p. 856) quotes this statement and appears to agree with it. The rust which occurs in this country on *Cnicus heterophyllus* (Plowright, 1889, p. 204; Grove, 1913, p. 146) has up to the present been regarded as the distinct species *P. Andersoni* B. & Br., but in view of Liro's discovery it must now be regarded as *Puccinia Cnici-oleracei* Pers.

Puccinia Cardui-pycnocephali Sydow has now been recorded by Hadden (1930) in Somerset, Ellis (1933–4) in Norfolk, Wilson (1934,

p. 369) in East Lothian and Berwickshire and Mayfield (1935) in Suffolk, in addition to the records given by Grove (1913, p. 142). *P. galatica* Sydow, at first separated from *P. Cardui-pycnocephali*, has been recognized as identical with it by Sydow (1904, p. 852).

Puccinia Cirsii-lanceolati Schroet., in Cohn, *Krypt.-Fl. Schles.* III, pt. 1, p. 317 (1887), should be known as *P. Cnici* Mart., *Fl. Mosq.* p. 226 (1817) as pointed out by Arthur (1934). It has been found recently on *Cnicus eriophorus* Roth., by Ellis and Rhodes near Oxford (Ellis *in litt.*).

Puccinia Cirsii Lasch has now been found on *Cnicus palustris* Willd., on *C. pratensis* Willd., in Galway (Grove, 1913) and in Surrey, on *C. acaulis* in Norfolk (Ellis, 1933–4) and in Wiltshire and on *C. heterophyllus* in Scotland (Wilson, 1934).

Puccinia Le Monnieriana Maire is stated by Maire (1913) to be identical with *P. Cirsiorum* var. 2 *Cirsii-palustris* Desm. *Pl. Crypt. France*, ed. 1, no. 557.

Puccinia Cirsiorum var. 1 *Cirsii-oleracei* is stated by Desmazières to be *Puccinia Cnici-oleracei*.

The valid name for *P. Le Monnieriana* should therefore be *P. Cirsii-palustris* (Desm.) comb.nov. This species is now known from Middlesex, Kent, Surrey, Hampshire, Norfolk, Suffolk, Cambridge, Worcestershire and from several localities in Scotland.

Puccinia suaveolens (Pers.) Rostr., common on *Cnicus arvensis* Hoffm., has been found on *Cnicus arvenis* Hoffm., var. *setosus* Bess., near Inverness, by Dr J. A. Macdonald (*in litt.*). As pointed out by Magnus (1903) *Puccinia suaveolens* (Pers.) Rostr. *Forh. skand. Naturf. Kopenhagen*, p. 339, 1873 is the valid name for this species and not *P. obtegens* (Link) Tul.

My thanks are due to the following for the loan of specimens and for facilities for the examination of material: the Director of the Royal Botanic Gardens, Kew; the Regius Keeper of the Royal Botanic Garden, Edinburgh; the Professor of Botany, the University, Birmingham; the Municipal Authority, Berwick-upon-Tweed. I wish to thank Miss E. M. Wakefield, Dr C. G. C. Chesters, and Dr G. R. Bisby for help and advice in the preparation of the paper.

Summary

1. Eighteen specimens of *Puccinia Syngenesiarum* have been examined, and of them fifteen have been found to be *P. Le Monnieriana* Maire on *Cnicus palustris*.

2. The mistaken identification by Cooke of *C. palustris* for *C. lanceolatus* as the host plant of *Puccinia Syngenesiarum* has very probably led to the erroneous citations of *Cnicus lanceolatus* as a host plant of

Puccinia Cardui Plowr. by Plowright and as a host of *P. Cnici-oleracei* Pers. by Grove.

3. Although the type specimen of *P. Cardui* Plowr. has not been examined, this species is almost certainly identical with *P. Le Monnieriana* Maire.

4. Notes of the nomenclature and distribution of the following species are given: *P. Cnici-oleracei* Pers. (*P. Andersoni* B. & Br.), *P. Cardui-pycnocephali* Sydow, *P. Cnici* Mart. (*P. Cirsii-lanceolati* Schroet.), *P. Cirsii* Lasch, *P. Cirsii-palustris* (Desm.) comb.nov. (*P. Le Monnieriana* Maire), *P. suaveolens* (Pers.) Rostr. (*P. obtegens* (Link) Tul.).

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A *PHYTOPHTHORA* BLIGHT OF BULBOUS IRIS

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(With 5 Text-figures)

The bulbous irises grown extensively in the south-west of England for cut flowers are mostly hybrids of *Iris xiphium* and *I. tingitana*. These so-called "Dutch Iris" are frequently attacked by leaf diseases. The ink disease (*Mystrosporium adustum* Mass.) which produces irregular black markings on leaves and stems frequently occurs, but does not destroy the bulbs of these varieties as it may those of *Iris reticulata*. The whitish irregularly circular lesions of Leaf Spot (*Heterosporium gracile* (Wallr.) Sacc.) often render the crop unsaleable.

In the Isles of Scilly the senior author has observed since 1928 an undescribed species of *Phytophthora* on the foliage of Dutch Iris. The disease appears regularly in wet seasons in March, April and May, but is difficult to find during a dry spring. It has also appeared once on iris boxed for forcing under glass. This blight occurs in Scilly on the varieties Wedgwood, Imperator and White Excelsior, and has also been found near Penzance on Jacob de Wit.

The blighted plants occur in patches several feet in diameter, and a bad attack is easily seen from a distance. The lower leaves of the affected plants bend over until their ends touch the ground, exposing the light green concave inner surface. Closer inspection shows that the leaves have collapsed at the site of necrotic lesions on the outer (distal) surface. Similar lesions are often present higher up the plant on younger leaves.

The affected tissue consists of a whitish lesion which, instead of remaining circumscribed as in Leaf Spot and Ink Disease, spreads rapidly up and down the leaf (Fig. 1). The first lesions appear to develop near the bases of the older and outer leaves, and it is suggested that infection here may be facilitated by the quantity of water which is often held between the sheathing leaf bases and the stem. Other lesions soon appear on the younger leaves and are carried up out of the water film as the axis of the plant elongates. In a longitudinal direction the individual lesions extend without restriction, but they tend to be prevented from spreading across the leaf by the

parallel vascular bundles. The lesions are thus sharply bounded by parallel sides along the length of the leaf, but their transverse ends merge indefinitely into healthy tissue. On the outer surface of the leaf the transverse ends of the lesion show a narrow pale yellowish green zone, and, within this, the lesion acquires a necrotic appearance which may be irregularly coloured light purplish brown or even

Fig. 1. Lesions of *Phytophthora* blight on foliage of Iris Wedgwood, from St Mary's, Isles of Scilly.

greyish white. Along the longitudinal edge of the lesion this hue contrasts sharply with the dark green of a normal leaf. The extreme tips of the leaves are not infected, but they wither when extensive lesions are present lower down. On the inner (proximal) surface of the leaf the lesion is much less obvious and is generally purplish grey.

After flowering, and towards the end of the growing season in the variety Wedgwood, the lower lesions extend down below soil level towards the new bulbs which are formed within the shrivelled skin of the parent bulb. On the subterranean part of the axis the

lesion is conspicuous as a dark purplish brown streak against the blanched surface of the lower sheathing leaf bases and stem. It is possible that the large hyphae, rich in protoplasm, which are found in this lesion, reach the newly formed bulbs and remain until the following spring, when reinfection can be established. The possibility that infection is carried by the bulb is supported by the record of the occurrence of the disease under glass.

The disease appears to spread somewhat slowly from one plant to another, and when bulbs are left down, blighted patches reappear in the same place in the following season. In addition, the plants in these second year patches are often markedly stunted and tend to die out.

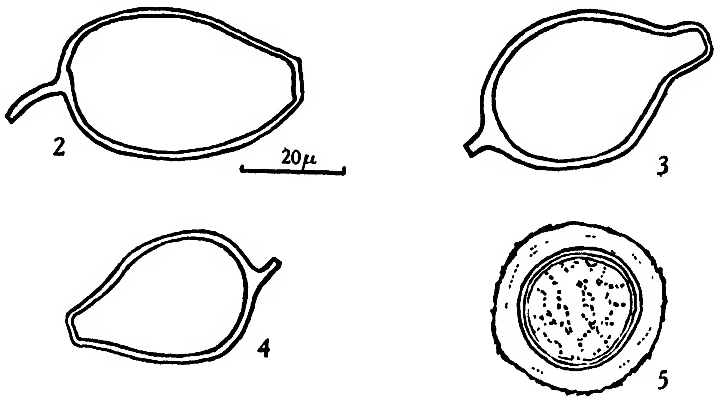
The fungus forms a sparse white powdery layer, comprising sporangia over almost the whole of the affected parts of the outer surface of the leaf, but not on the inner surface. The sporangia are produced in short compact clusters on sporangiophores emerging from the stomata. They are frequently beaked and appear to be applanate. The apex is nearly flat and the thickening relatively shallow. They separate readily from the short sporangiophores and each bears a short occluded pedicel (Figs. 2–4). The sporangia measure $37–66 \times 24–40\,\mu$. Zoospores are differentiated in the sporangium and scatter immediately after emission. Zoospores are sluggish in movement and measure, when rounded and at rest, mostly $8–12\,\mu$. Specimens were kindly examined by Mr S. F. Ashby, of the Imperial Mycological Institute, who considered that the fungus is not improbably related to certain species recorded on sedges in the Far East, especially *Phytophthora Cyperi-rotundati* Sawada.

Repeated examination of young and old lesions on leaves and stems both above and below soil level during spring and summer failed to reveal the presence of sexual organs. On overwintered leaves, however, bodies $32–44\,\mu$ in diameter, resembling oogonia, and containing oospore-like bodies $27–35\,\mu$ in diameter, were observed (Fig. 5). These may belong to the *Phytophthora* but as no antheridia were seen the connexion is not yet established. It is not yet clear therefore whether the fungus passes the summer in portions of the old plant attached to the newly formed bulbs, or in fragments of withered leaves on the surface of the soil.

During the years 1937–9, numerous unsuccessful attempts were made to grow the organism on a variety of culture media. In 1937 and 1938, portions of leaves bearing sporangia were placed in the water retained in leaf bases of healthy plants of Wedgwood and *Iris tingitana* under bell-jars at Newton Abbot, but no infections resulted.

Control measures have not been fully worked out, and a spraying test with Bordeaux mixture out of doors was complicated by the

presence of Leaf Spot. Under glass, infection seems to have been controlled by avoiding watering the plants from overhead, so as to prevent the accumulation of water in the sheathing leaf bases. Out of doors each leaf in its development passes up through a film of water held in a leaf base, and conditions would therefore be favourable for infection by motile zoospores. It is possible that a light application of a soluble fungicide might prove adequate to control the disease if a sufficient concentration could be held in the leaf bases. Careful



Figs. 2–4. Sporangia from leaf lesions on Iris Wedgwood.
Fig. 5. Oospore associated with *Phytophthora* blight on overwintered leaves of Iris Wedgwood.

cleaning of foliage from beds to be left down for more than one year, the discarding of bulbs from diseased plants, and planting only sound bulbs on clean land are obvious precautions to be adopted until more is known about the origin of this disease.

Summary

A description is given of a blight of the foliage of several varieties of Dutch Iris which has occurred in the Isles of Scilly since 1928. The disease is associated with an unidentified *Phytophthora* which is possibly related to *P. Cyperi-rotundati* Sawada. Suggestions for control are based upon measures of plant sanitation.

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TWO DISEASES OF GRASSES CAUSED BY SPECIES OF *HELMINTHOSPORIUM* NOT PREVIOUSLY RECORDED IN BRITAIN

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(With 2 Text-figures)

I. *Helminthosporium siccans* Drechsler

SYMPTOMS. Brown lesions associated with a species of *Helminthosporium*, identified then as *H. gramineum* Rabenh., were observed on leaves of perennial rye-grass in Wales as far back as 1921 (Sampson, 1922), but the disease was not closely studied until recently. While the disease is not highly destructive, lesions are seldom absent from rye-grass plots in this district, and at times they occur in sufficient abundance to produce a brown effect on the plants, notably in early spring and autumn when the fungus seems to be a contributing factor to "Winter Burn". The disease has been observed not only in Wales, but also in many English counties.

Small infections consist of oval, chocolate-brown spots which finally become white in the centre. Larger lesions take the form of dark streaks a centimetre or more in length. Infections are discontinuous, totally unlike the systemic type produced by *H. gramineum* on barley. Sometimes the mesophyll is completely destroyed, leaving only the veins, and the lamina bends or breaks at the place of infection. Infected plants possess many leaves with dead tips on which the fungus readily fruits. Distorted and discoloured spikes have been found with conidiophores on the bleached glumes of dead spikelets and spores have been found on viable seeds. Similar symptoms occur on *Lolium perenne* Linn., *L. multiflorum* Lam., and *Festuca pratensis* Huds.

Isolation of the parasite and inoculation experiments

The preparation of pure cultures presents no difficulty as the large spores can be picked off under a binocular microscope, and they rarely fail to germinate on the surface of agar. Ten or twelve monospore cultures have been prepared from each host and grown on various media. The following inoculation experiments were carried out.

Exp. 1, *January* 1938. Two pot plants of perennial and of Italian rye-grass were inoculated by smearing marked leaves with spores and mycelium from pure cultures, sprayed with sterile water and kept in a moist chamber for several days. All the inoculations of Italian rye-grass with a culture obtained from the same host were successful, typical brown lesions being produced. One lesion developed on perennial rye-grass inoculated with spores from Italian rye-grass, while the control plants and those inoculated with a culture derived from perennial rye-grass remained healthy.

Exp. 2, *November* 1938–*March* 1939. Grains of the two rye-grasses and of meadow fescue were treated with 0·1 % mercuric chloride solution in sterile water, washed, and germinated on the surface of agar in sterile Petri dishes. Seedlings which remained free from mycelium were transplanted to pots of sterilized soil* which had been mixed with rye-grass chaff heavily infected with the appropriate cultures of *Helminthosporium*. The unit for each part of the experiment consisted of at least five pots each containing five seedlings. The different series of pots were kept in an unheated glasshouse in compartments separated by double muslin partitions. All the control pots remained free from infection, while a trace developed in the following inoculated series: *Lolium perenne* inoculated with cultures derived from *L. multiflorum* and *Festuca pratensis*; *L. multiflorum* inoculated from *L. perenne*; *F. pratensis* inoculated from *L. perenne* and *L. multiflorum*.

Thirty per cent of the seedlings became infected when *L. perenne* was inoculated with its own strain. Infected seedlings showed lesions on the second or third leaf and in the moist atmosphere of the glasshouse the fungus sporulated freely.

The establishment was satisfactory in all units except that of *Festuca pratensis* in soil contaminated with inoculum from the same host, where only about half the seedlings appeared above ground. A search revealed several seedlings which had failed to reach the surface, and the damaged shoots carried abundant conidia. A similar effect was obtained in Exp. 3.

Exp. 3, *November* 1939–*February* 1940. Three large (8 in.) pots of sterilized soil were inoculated with isolates of *Helminthosporium* from (*a*) *Lolium perenne*, (*b*) *L. multiflorum*, (*c*) *Festuca pratensis*, and 350 seeds of *F. pratensis* were sown in each pot. Germination was retarded by cold in the first weeks of the experiment, and an establishment of only 33 % was obtained in the control pots. The seedlings in these pots remained free from disease while in the inoculated series the numbers of seedlings with typical lesions were as follows: pot (*a*) 7, pot (*b*) 13, pot (*c*) 3. Establishment in pot (3) where the inoculum

* Moist soil was kept at a temperature of 95–100° C. for 4–5 hr. Experiments showed that mycelium and spores of *Helminthosporium* were killed by this treatment.

came from *F. pratensis* was only 23 %, 10 % lower than in the control series, a result which confirms that obtained in Exp. 2. It is concluded that the strain on meadow fescue can infect both species of rye-grass and that meadow fescue seedlings growing in heavily infected soil are liable to attack before reaching the surface.

Exp. 4, *March* 1940. Young plants of *Festuca pratensis* sprayed with a suspension of spores of *Helminthosporium siccans* from a culture from *Lolium perenne* developed typical lesions.

While the problem of physiologic specialization in this species has not been fully investigated, the results so far obtained indicate clearly that the fungus can pass from rye grass to meadow fescue and *vice versa*.

Table I. *Showing the size and septation of spores of* Helminthosporium siccans *taken from different hosts and from culture media*

	Length in μ		Width in μ		No. of septa	
Origin of spores	Range	Av.	Range	Av.	Range	Av.
Lolium perenne:						
Plant	49–215**	109·0	12–22	16·5	2–15	6·7
Tap-water agar	27–97	72·3	12–20	15·4	1–7	4·2
Potato-dextrose agar	20–84	55·6	10–18	13·5	1–6	3·2
Lolium multiflorum:						
Plant	30–173	95·9	10–17	13·6	1–9	5·6
Tap-water agar	17–100	65·2	10–20	14·3	1–6	4·3
Potato-dextrose agar	17–97	44·6	8–23*	13·2*	0–6	3·1
Festuca pratensis:						
Plant	43–127	88·9	10–20	14·8	2–8	5·3
Tapering type on tap-water agar	30–87*	56·3*	10–17*	13·3*	2–6*	4·2*
Cylindrical type on tap-water agar	20–123*	78·2*	10–17*	14·9*	2–6*	4·6*
Cylindrical type on potato-dextrose agar	30–77	53·9	7–13	11·2	0–7	3·9
Helminthosporium siccans Drechsler *Lolium perenne* and *L. multiflorum* plant (Drechsler, 1923)	31–160	80·1	11–20	16·8	2–10	4·9
Helminthosporium dictyoides Drechsler *F. elatior* (Drechsler, 1923)	23–115	74·5	14–17	16·1	1–7	4·4

** All measurements are based on 200 spores except those marked with an asterisk. At least 100 spores were measured in all samples.

Identification of the parasite

The dark brown, septate, geniculate sporophores, typical of the genus *Helminthosporium*, arise freely on dead tissues. They are almost invariably solitary, rarely in twos or threes, and vary greatly in length, reaching a height of 200 μ. The lowest cell is usually swollen at the base.

The conidia, upon which the classification of the genus chiefly

rests, are subhyaline, straight, cylindrical or tapering, with the hilum entirely included in the exospore. The species has therefore affinities with *H. gramineum* Rabenh., and other members of the subgenus *Cylindro-Helminthosporium* of Nisikado (1929).

Species of *Helminthosporium* attacking members of the Gramineae of temperate regions have been most fully studied by Drechsler (1923) who described several new species, including *H. siccans* on *Lolium multiflorum* and *L. perenne*, and *Helminthosporium dictyoides* on *Festuca elatior* L. (= *F. pratensis* Huds.). These species are much alike, distinguished morphologically chiefly by the slightly more tapering spores of the latter species. They are described as producing somewhat different symptoms; the lesions on rye-grass have the form of spots, while those on meadow fescue are reticulate, recalling the net blotch of barley caused by *Helminthosporium teres* (Drechsler, 1923).

In material studied at Aberystwyth, the symptoms on the two rye-grasses and on meadow fescue are alike, and correspond with those on Italian rye-grass described by Drechsler. Spores taken from the host plants vary much in shape. They may be cylindrical with hemispherical end cells, or tapering from base to apex with an end cell which narrows towards the hilum (Fig. 1).

Of six monospore cultures obtained in October 1939 from *Festuca pratensis*, three developed the cylindrical type of spore in culture, while the others produced spores which were slightly shorter, more slender, tapering towards the tip, and with a narrow basal cell. The two types maintained these characters in subcultures and they could also be distinguished by their growth on certain media. Isolates so far studied from *Lolium multiflorum* tend to agree with the tapering fescue type, while isolates from *L. perenne* resemble more closely the cultures from fescue that have cylindrical spores, but some were found to be intermediate between the two types.

Other species of *Helminthosporium* include races which differ rather widely in cultural characters and size of spore (Christensen & Graham, 1934), and it seems best to include all the forms isolated by us from these three grasses in a single species. As the brown discoloration produced on the foliage does not take the form of a net as described for *H. dictyoides*, and as the spore characters agree closely with *H. siccans* which is figured with both cylindrical and tapering spores (Drechsler, 1923, Pl. 12), the fungus attacking meadow fescue and the two rye-grasses in Britain is placed in this species. It should be recognized, however, that *H. siccans* Drechsler is a species which comprises strains that differ not only in cultural characters, but also in the shape and size of spore.

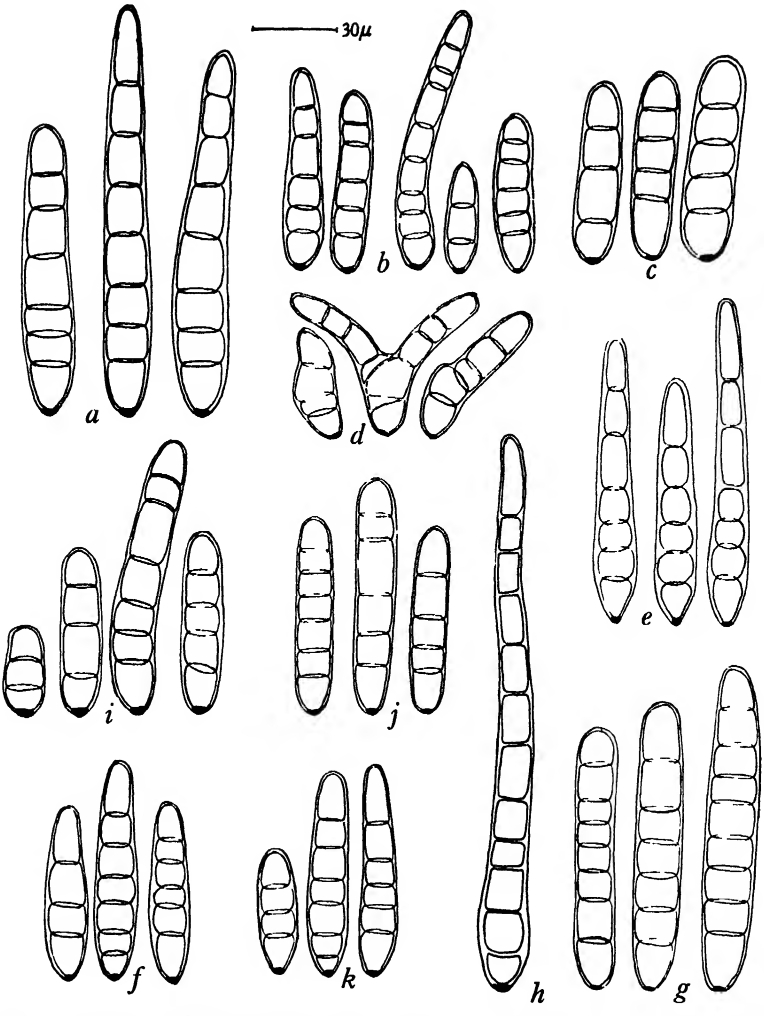

Fig. 1. Spores of *Helminthosporium siccans* Drechsler. *a–d*, strain from *Lolium perenne*; *a*, from leaf; *b, c*, from tap-water agar; *d*, from potato-dextrose agar. *e, f*, strain from *L. multiflorum*; *e*, from leaf; *f*, from tap-water agar. *g–j*, strain from *Festuca pratensis*; *g, h*, from leaf; *i* and *j* show cylindrical type on potato-dextrose agar and tap-water agar respectively; *k* shows the tapering type on tap-water agar. The spores shown in *d* and *h* are slightly abnormal. ×400.

The growth of Helminthosporium siccans *in culture*

Cultures were grown mostly on potato-dextrose agar, oatmeal agar and tap-water agar. On the first two media, abundant mouse-grey aerial mycelium developed on a matrix of much darker mycelium. Monospore cultures varied slightly in colour and in the extent to which sclerotia were formed. Submerged sclerotia were usually minute and abundant. At the margin of dishes and in test-tubes black horn-shaped bodies were formed, originating as appressoria where mycelium touched the glass. These formed a characteristic feature of a series of cultures from Italian rye-grass and meadow fescue which had slender tapering spores.

A few cultures developed tufts of white aerial mycelium which sometimes spread over the surface of the colony. Transfers of the white mycelium gave cultures with dark submerged mycelium and a uniform white surface growth.

Sporulation which is delayed until the cultures are at least four weeks old varies considerably in different strains, some remaining persistently sterile. Tap-water agar is most useful since it gives spores which come nearer in size to those produced on the host, and it induces sporulation in some isolates which remain sterile on potato-dextrose agar. The spores produced on this medium were smaller than those on tap-water agar (Table I). In cultures of *H. siccans*, spores usually arose in great numbers from a few conidiophores attached to a dark sclerotial mass. In only a few cultures were the sporophores distributed evenly over the surface of the agar.

II. ***Helminthosporium vagans*** Drechsler

In 1921, plants of *Poa pratensis* growing at the Welsh Plant Breeding Station were affected with a leaf spot, apparently caused by a species of *Helminthosporium*. The disease has occurred since, but never in a severe form. In March 1938, samples of newly established turf showing brown discoloration of the blades and sheaths were sent to us by Dr Dillon Weston. The grasses included smooth-stalked meadow grass, from which the spores of a *Helminthosporium* were readily isolated and cultured. The same symptoms have been seen again on this grass in turf in a garden at Aberystwyth.

The lesions on the lamina are dark purplish red, the centre changing to light brown and finally white. They are often found in rows along the margin, but a single lesion may extend across the whole leaf. The discoloration of the tissue not uncommonly extends down the sheath to the base of the plant, and in close turf a decay of the foot-rot type sets in at ground level. In pot plants artificially inoculated and later removed for examination, brown lesions were found on the white underground rhizomes, especially on the terminal

bud, and it was evident that the fungus had interfered with the natural spread of the plant.

The fungus fruits abundantly on the bleached centre of the lesions and on withered leaf tips. It has not been seen on any part of the inflorescence.

Inoculation experiments

These were conducted by planting healthy tillers of several species of grass in sterilized soil in 5-in. pots, to some of which cultures of *Helminthosporium vagans* from *Poa pratensis* had been added. The control plants remained free from the disease, while all the plants of *P. pratensis* grown in the inoculated soil developed typical leaf lesions. The first sign of disease was evident in two weeks, and the disease continued to develop for two months, the fungus fruiting abundantly on the dead tissues. It also attacked the rhizomes (see p. 260). *Lolium italicum*, *Phleum pratense*, *Poa trivialis* and *Cynosurus cristatus* treated in the same way did not become infected with *Helminthosporium vagans*.

Identification of the species

The conidiophores arise singly or in small groups and are rather densely crowded in the light centre of the lesion. They begin to cut off conidia when rather short (20 μ) but finally attain a length of 200 μ or more, rarely branching. The spores differ in colour, shape and septation from those of *Helminthosporium siccans*. They are dark brown, relatively wide in the centre, and taper to each end, possessing numerous septa which are somewhat close together (Fig. 2). The distance between septa averages 12 μ as compared with 14 μ in *H. siccans*. As in *H. siccans*, the hilum is included in the contour of the outer wall. Data relating to size and septation are shown in Table II. The fungus has been identified on symptoms and spore characters as *H. vagans* Drechsler (Drechsler, 1923, 1930), but it should be noted that material studied at Aberystwyth gave spores which were considerably longer and had a higher number of septa than those measured by Drechsler (Table II). *H. vagans* is a type which shows affinity with both *H. sativum* Pam. King & Bak. and *H. gramineum* Rab. (Drechsler, 1923).

Table II. *Showing the size and septation of spores of* Helminthosporium vagans *Drechsler on* Poa pratensis

	Length in μ		Width in μ		No. of septa	
Origin of spores	Range	Av.	Range	Av.	Range	Av.
Aberystwyth:						
Plant	46–198	132·5	15–25	18·2	3–15	10·2
Tap-water agar	30–106	69·5	13–26	17·8	3–9	5·5
Helminthosporium vagans (Drechsler, 1930)	31–140	82·7	11–25	19·1	2–12	6·3

Growth of Helminthosporium vagans *in culture*

In contrast to *H. siccans*, the species from *Poa pratensis* grows relatively slowly, forming on oatmeal agar and on potato-dextrose agar a very compact colony with olive-green aerial mycelium which tends to develop radiating strands and a black reverse. Only a few spores were found on potato-dextrose agar. On tap-water agar sporulation was more abundant, but sparse relative to the most

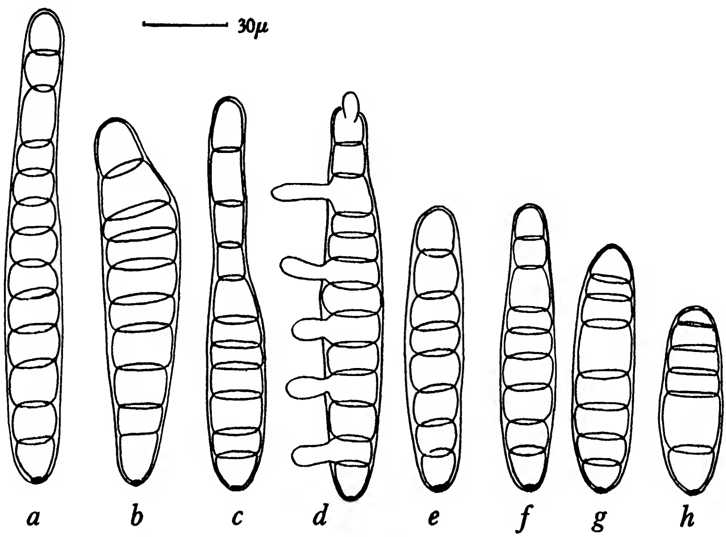

Fig. 2. Spores of *Helminthosporium vagans* Drechsler. *a–f*, from leaf of *Poa pratensis*; *g*, from culture on tap-water agar; *h*, from potato-dextrose agar. Spores *b* and *c* are slightly abnormal. ×400.

fertile strains of *Helminthosporium siccans*, the spores arising in twos and threes from conidiophores scattered over the whole surface of the agar. Monospore cultures of *H. vagans* were, in our experience, relatively uniform.

Summary

Two species of *Helminthosporium* are recorded for the first time in Britain, *H. siccans* Drechsler on *Lolium perenne*, *L. multiflorum* and *Festuca pratensis* and *Helminthosporium vagans* Drechsler on *Poa pratensis*.

Monospore cultures of both species have been studied. Certain isolates of *H. siccans* showed slight but consistent variations in cultural characters and in the size and shape of the conidia.

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PROCEEDINGS

DISCUSSION ON PLANT DISEASES AND THE WEATHER

Held on 17 February 1940, in the rooms of the Linnean Society of London, Burlington House

The President, Dr H. WORMALD, in the Chair

W. C. MOORE. Weather in relation to plant disease survey records.

A monthly summary of plant disease records from various sources in England and Wales is prepared at the Ministry of Agriculture's Plant Pathological Laboratory at Harpenden, and although for various reasons it is difficult to frame conclusions about weather and plant diseases by studying the summaries in conjunction with weather maps, some broad conclusions can be drawn regarding combined weather effects on the occurrence and severity of diseases. Thus Potato Blight, Downy Mildew of hops and all Downy Mildews are regarded as "wet weather" fungi, while powdery mildews are more prominent in dry seasons. A wet May is regarded as a portent of a bad Apple Scab year; Chocolate Spot of Beans may be expected to develop during periods of dull showery weather between April and July; Clover Rot seems worse when a mild winter follows a wet autumn. The sudden spread and destructiveness of *Antirrhinum* Rust in this country can undoubtedly be correlated with the succession of hot summers that began in 1933. Severe attacks of Gooseberry Cluster Cup Rust followed a dry March in the years 1929, 1931 and 1933. Dr Alex. Smith suggested that when March is dry, teleutospore germination on the alternate sedge host is delayed, and occurs with a rush at a time when there is a large surface area of gooseberry foliage on which spores can alight. A fairly severe attack in 1938 was successfully predicted. Care must be taken not to attribute to local climatic conditions effects due to regional differences in the extent to which the host plant is cultivated, e.g. Leek Rust is said to be more common in the north of England than in the south. The reliability of these generalizations and the precise nature of the factors underlying them can be determined only by special investigations.

R. W. MARSH. Apple Canker and the weather.

Spore discharge. Rain is of paramount importance in discharge of both the conidia formed on cankered wood from spring to autumn, and of the perithecia which succeed them. Conidia may be spattered up to 30 ft. when wind accompanies rain. Vaselined slide spore traps showed that ascospore discharge was very closely correlated with the presence of rainfall, but not with temperature, humidity, wind or sunlight. In the field, spore discharge went on at all seasons at any temperature during which rain fell, but in laboratory tests it was checked at 2–3° C.

Spore germination and mycelial growth. Ascospores of *Nectria galligena* will germinate at from 2 to 30° C. (optimum about 25° C.), but are killed by 5 days' desiccation. The mycelium can grow between 2 and 37° C. (optimum 20° C.). This tolerance of low temperatures, combined with a high rate of spore production in autumn, winter and spring, contributes materially to the success of *N. galligena* in infecting the dormant tree. Infections may be through leaf scars, scab infections, woolly aphis galls and bark disruptions such as pruning cuts and wounds. Leaf scar infection is possible in spring and autumn, but not in mid-winter. Infection through pruning cuts, however, can occur at any time in autumn, winter and spring. Freshly made wounds are the most susceptible, so pruning is advised during cold dry periods when spores are not being discharged. The wounds are thus given the chance of becoming more resistant through ageing before spore dissemination is resumed.

The erratic incidence of the disease is emphasized and weather may be important in some instances and in others subsidiary to some pomological factor.

R. V. Harris. A functional disorder of cultivated varieties of *Rubus*.

A widespread Die-Back of Lloyd George raspberry canes has been investigated at East Malling Research Station. Buds on the fruiting canes either fail to grow out, or produce undersized laterals with the leaves down-curled and developing interveinal and marginal scorching. In extreme instances complete stools may die out, but the growth of young spawn on surviving stools is stimulated. No pathogen was implicated but examination of records of Die-Back revealed an apparent correlation with winter temperatures, and preliminary experiments were started. Plants of the variety Lloyd George were placed, from December to February inclusive, in (*a*) a cold storage chamber at 31·5° F., and (*b*) a heated greenhouse of a mean temperature of 48° F. The plants were then kept till the following winter in a cool orchard house. Deleterious symptoms occurred only on plants kept at the mild winter temperature; 81 % of the fruit canes died, and leaf, crown and root symptoms resembled those of Die-Back in the field. Vegetative growth of the stool was stimulated. The raspberry variety Baumforth's Seedling B showed no modification at the mild winter temperature, but in further experiments Die-Back occurred on Loganberry, Phenomenal Berry and Himalaya Berry cool-stored at 40° F.

It is suggested that the Die-Back is the result of imperfect breaking of the winter rest period owing to inadequate exposure to low winter temperatures, but other factors such as soil drainage and weak fungus parasites may intensify the symptoms.

T. H. Harrison. Climate and disease in Australia.

As an island continent, Australia exhibits wide variations in climate.

The relation of weather to incidence of disease is complex, as can be illustrated by reference to the disease Brown Rot of fruits caused by *Sclerotinia fructicola* (Wint.) Rehm. In Australia this fungus does not produce conidia on twigs and cankers as does *S. laxa* in England. On mummified fruits, conidial pustules can be dried up and killed in a few hours by hot dry winds but a new crop may be developed in a few days in suitable weather. As many as sixteen successive crops of conidia from individual mummified fruits have been noted in New South Wales. Conidia from rotting or mummified fruits are mainly responsible for spreading the disease rapidly through growing or ripening fruits of which the liability to infection is influenced greatly by climatic conditions.

If mummified fruits are allowed to rest undisturbed under suitable environmental conditions, apothecia may be produced in the spring, usually coincidentally with blossoming of stone fruits such as plums, peaches and apricots. Similar climatic variations affect both blossoming and apothecial development. Ascospore clouds may be ejected to cause infection of blossoms if satisfactory climatic conditions prevail both for ejection and germination of spores. The requirements were discussed in detail.

Control of this disease depends on the prevention or reduction of initial infection in the spring by destruction of mummified fruits and prevention of apothecial development and timely applications of protective fungicides to growing and maturing fruits.

The fallacy of blaming climatic conditions prevailing at time of appearance of disease in very conspicuous form is demonstrated by reference to Peach Scab or Freckle. The weather prevailing before bud burst when infection takes place has a profound influence on disease which shows up when leaves fully expand.

Other instances of the influence of climatic conditions on incidence of disease were quoted and the conclusion reached that a careful study of meteorological data and its correlation with etiological data should make it possible to forecast severe outbreaks of disease of most crops and therefore enable preventative measures to be adopted speedily.

Mary E. King and R. V. Harris. The strawberry yellow-edge disease in relation to weather conditions.

On the strawberry variety Royal Sovereign it was early observed that the diagnostic symptoms of Yellow Edge were prominent in June or July and again to a

maximum extent in the autumn, and roguing was therefore carried out during these periods. Since 1935, observations have been made using a numerical scale to record the relative intensity of the disease symptoms. A study of soil temperature and rainfall showed a correlation between intensity of symptoms and weather in the preceding week or fortnight. Symptoms do not develop until a certain temperature is reached, usually during June or July. During the following intermediate phase temperature is sufficiently high, but soil moisture becomes a factor limiting development of symptoms. (A rise in soil moisture after several pronounced drought periods in 1939 was followed a week or a fortnight later by an increase in symptom intensity.) In the final phase in late autumn the soil moisture remains at saturation point but the symptoms become less pronounced as the temperature falls. Since young leaves show Yellow-Edge symptoms most clearly the lag between the occurrence of suitable weather conditions and appearance of symptoms probably represents the time necessary for the development of young leaves. Roguing is most efficient if carried out when symptom intensity is greatest and it is now possible to forecast good roguing conditions for Royal Sovereign.

M. H. Moore. The effect of weather on some diseases of apple and Morello Cherry.

Apple scab. While temperature is important for the rapid development of perithecia of *Venturia inaequalis*, adequate moisture from rain or dew is both essential for the discharge of ripe ascospores, and conducive to infection. In south-east England ascospores are ejected mainly towards the end of April, and seasonal variations in bud development can condition the success or failure of a fixed spray programme. Wet, and especially cool windy weather at the time of ejection of ascospores or at the, usually earlier, ripening of conidia, may lead to an epidemic of scab unless checked by spraying. Post-blossom infection tends to be less damaging than earlier infection, but is less easily controlled by the weak sprays then necessary for safety. The influence of rootstock, cultural and manurial treatment on the degree of infection appears to be governed largely by seasonal conditions.

Brown Rot in Morello Cherries. In the course of experiments on killing of winter pustules of *Sclerotinia laxa* by tar oil, it was found that very little infection occurred when the weather was dry at flowering time, but infection spread like fire in 1937, when the weather was wet while the morellos were in flower.

Branch Blister in Cox's Orange Pippin. Experiments in Essex showed that this disease, which is regarded as functional and not due to parasitism by *Coniothecium chomatosporum*, was caused primarily by drought, and affected trees grew normally without blister after they had had plenty of rain during the growing season.

A. Beaumont. Potato Blight and the weather.

The first outbreak of Potato Blight to be observed generally occurs in Cornwall and outbreaks occur in other counties more or less in order from south-west to north-east. This is not due to a spread of disease in this direction but because the weather conditions favourable to the outbreak of blight occur earliest in Cornwall and later in the north and east. Dutch scientists first formulated rules for the weather conditions favourable to the initiation of blight epidemics. When these rules were tested in England by Wiltshire it was found that they indicated blight rather more frequently than it occurred. This has been confirmed in Devon and Cornwall and it has been shown that better results are given by simpler rules: (1) minimum temperature not less than 50° F.; (2) relative humidity over 75% for at least 2 days. Observations of daily weather maps have shown that these conditions occur when a large depression is approaching *slowly* from the west. Localities to the south-east of the depression usually experience relatively high temperature and humidity and if the depression is moving slowly these conditions will last long enough to initiate the blight epidemic. Very typical conditions occurred in 1939 during the period 4 to 9 July and were responsible for the main epidemic in most counties. It is claimed that with the above information all the main blight epidemics can be forecast with reasonable accuracy.

Meeting held in the Rooms of the Linnean Society of London, Burlington House, Piccadilly, London, W. 1 on Saturday, 20 April 1940, at 11 a.m.

The President, H. Wormald, D.Sc., A.R.C.Sc., in the Chair.

Dr E. M. Turner. The reaction of oats to different strains of *Ophiobolus graminis* (Royal Holloway College).

Recent reports from Wales of oats attacked by *Ophiobolus graminis* (Take-All) conflict with the generally held opinion that oats resist that fungus. Isolations from infected oat stubble from Wales gave a fungus indistinguishable in culture from *Ophiobolus graminis* isolated from wheat. Four varieties of oats, strongly resistant to isolates from wheat, were very susceptible to those from oats. Measurements of numerous ascospores from the different strains gave a range in length of 98–117 μ for the fungus from oats, and one of 79–96 μ (the usual range for *Ophiobolus graminis*) for that from wheat. It appears that the fungus from oats is a new variety of *O. graminis*.

The cells of oat roots oppose a protoplasmic resistance to normal *O. graminis*, the fungus invading the seedling roots but disappearing in about three weeks. The fungus from oats, however, invades oats just as the normal strain invades wheat. Extracts were made from the roots of wheat and of oats and their effect on the growth of the isolates tested. Isolates from oats always grew well in these experiments, but those from wheat did not grow in untreated or in steamed oat extract, or in the sediment left after the extract was centrifuged. They grew fairly well in oat extract which had been passed through an L5 filter candle, and in the supernatant liquid obtained by centrifuging; they grew well in wheat extract.

It is concluded that there is a substance in the solid portion of oat extract which is toxic to the fungus isolated from wheat.

Dr M. A. Brett. Fungal infection of *Ulex minor* Roth. (Preliminary account.) (Northern Polytechnic.)

A white powdery infection of the anthers of *Ulex minor* Roth. (*U. nanus* Forst.) was originally recorded by Miss A. D. Betts, but not identified. Unicellular conidia of several types occur on the anthers, and sections reveal that three different mycelia may be concerned in the infection. Some information has been gained about two of these.

The first (not yet identified) forms smut-like spore balls in the anther cavities, but it is not known to which of the surface conidia this is related. Only unripe spore balls in preserved material have been observed.

The second mycelium grows to the surface of the anthers, and there forms identifiable conidia. Insects distribute them and pollinate the flowers simultaneously. Fertilization follows, and seeds develop to their full size, but are attacked by a mycelium which enters by the funicle, and forms spore balls in the pods corresponding to descriptions of the genus *Thecaphora*. On germination, these have so far produced only a weak mycelial growth which died away, and no connexion has been established between them and any of the anther conidia. The results of infection experiments are not yet available.

The mycelium which attacks the seeds differs from the other mycelia in appearance, and it is possible that this is formed after conidial fusions, many such having been observed at the time of pollination. The conidial forming *Thecaphora* mycelium would thus perennate in the haploid condition, and diplophytic mycelia be produced annually in the pods.

Dr S. Dickinson. Experiments on the Physiology of Obligate Parasitism I.

[The author did not supply a summary.]

Dr Roger Heim. The Fungi of Termite nests in West Africa.

[The summary of this paper has not been received, for shortly after Dr Heim returned to Paris, communication with him was broken by the development of the war.]

Dr C. G. Chesters. A note on the isolation of soil fungi.

[The author did not supply a summary.]

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OPHIOBOLUS GRAMINIS SACC. VAR. *AVENAE* VAR.N., AS THE CAUSE OF TAKE ALL OR WHITEHEADS OF OATS IN WALES

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I. INTRODUCTION

THROUGHOUT the wheat-growing areas of the world in which the Take All disease, due to *Ophiobolus graminis* Sacc., is prevalent, the growing of oats is regarded as a valuable control measure. Where attack by *O. graminis* is the factor limiting yield, a wheat crop following oats generally gives a yield equal to or approaching that of a crop after fallow. The empirical discovery of this fact is probably due to the farmers of South Australia, where a Commission was appointed as early as 1868 to inquire into the distribution caused by the disease, though its connexion with *O. graminis* was not established by McAlpine until 1902. Rotation of wheat with oats for the control of Take All was urged by McAlpine (1904) in Victoria, by Richardson (1910) in South Australia, and by Darnell-Smith & McKinnon (1915) in New South Wales.

This conclusion has been confirmed by pot experiments under controlled conditions demonstrating the high resistance of oats to infection by *O. graminis*; such experiments were reported by Wolf & Lehman (1924) and by Kirby (1925) in the United States of America, by Schaffnit (1930) and by Muller-Kögler (1938) in Germany, by Russell (1934) in Canada, and by Föex (1935) in France. Contrary results were, however, reported by Ducomet (1913) in France and by Osborn (1919) in South Australia; both examined specimens of diseased oats carrying perithecia of *O. graminis*. Darnell-Smith & McKinnon (1915) stated that a single case of oats attacked by Take All had been recorded in New South Wales. More recently, outbreaks of Take All in oats have been reported by Gram (1929) in Jutland, and by Van Poeteren (1932) in Holland. Hynes's (1937) claim to have demonstrated susceptibility of oats to two isolates of *O. graminis* in pot tests in New South Wales is of doubtful value. He tested six isolates, incorrectly designated strains, of *O. graminis* against three varieties of wheat, two of oats, and one each of barley and rye, in pots. Two of the isolates caused some retardation in growth of the oats. As the proportion of fungus inoculum (cooked wheat and oat kernels) to

surface soil was approximately 1 : 2 by volume, a purely toxic effect of the inoculum might well have caused the stunting.

Increasing interest in Take All in wheat and barley crops in this country during the last few years has made the immunity of oats an urgent matter. Field observations, such as that by Dillon Weston (1938) in Norfolk, suggest that oats may safely be recommended as a rotation crop for control of the disease. On the other hand, recent unpublished reports of Take All affecting oat crops in Wales, communicated by Mr D. Walters Davies and Dr T. Whitehead, have been too numerous and well-authenticated to be ignored. There are other records. Massee (1912) found plate mycelium and perithecia of *O. graminis* on diseased oat plants received at Kew from Corwen in North Wales, isolated the fungus and reproduced the disease in both wheat and oat seedlings, and Jones (1926) studied the cytology of development of the perithecium of *O. graminis* in material collected on oat stubble near Aberystwyth.

The susceptibility of oats to the Take All disease in Wales might be due to at least one of three possible causes, viz. the employment of peculiar varieties of oats, breakdown in resistance of the plant owing to some unfavourable condition of the environment, or the existence of a distinct biological strain of *O. graminis*, if not of another species of *Ophiobolus*, in Wales. The experiments described below are concerned both with the properties of the Welsh isolates of *Ophiobolus* from oats, and with the resistance of oats to English isolates of *O. graminis* from wheat.

II. Experimental

(*a*) *Isolation of* Ophiobolus *from oats and wheat*

Three isolates of the oat-attacking *Ophiobolus* were obtained in September 1937 from infected oats collected by Miss M. D. Glynne from Pentrevoelas, Denbighshire (isolate O 3), from Caervon, Anglesea (O 4), and from Beaumaris, Anglesea (O 13). Three further isolates were obtained in the late summer of 1938 from material collected by Mr D. Walters Davies at Aberystwyth (O 20), and from further collections made by Miss Glynne in Carnarvonshire, near Bodfaen (O 21) and near Edern (O 23). English isolates of *O. graminis* were made from infected wheat collected in 1937 from Dorset (W 1), from Broadbalk field, Rothamsted (W 2), and from Mr W. Buddin's experimental plots at Reading (W 3). In 1938, two further isolates (W 4 and W 5) were obtained from one collection of infected wheat from Wareham, Dorset.

Where ripe perithecia were present on infected stubble, *Ophiobolus* was most easily isolated by arranging for the ejection of ascospores on to a sterile cover-slip suspended not more than 1 mm. above the necks of the perithecia (Samuel & Garrett, 1933). If ripe perithecia were

not present, wheat or oat grains were planted in the cavities of selected pieces of infected stubble, which were then buried in pots of moist sand. Isolations of *Ophiobolus* were more readily obtained from the young lesions on infected seedling stems than from the original infected stubble, in which other fungi were always present. The silver nitrate method of surface sterilization recommended by Davies (1935) for the isolation of *O. graminis* was employed.

(*b*) *Host range of* Ophiobolus *isolates from oats and wheat*

Experiment I. In the first glasshouse inoculation experiment, six isolates of the fungus, three from oats (O 3, O 4 and O 13) and three from wheat (W 1, W 2 and W 3), were tested against Little Joss wheat and Victory oats in seven-inch pots of sand with a nutrient solution; each series comprised twenty replicate pots. The inoculation technique used by Garrett (1936) was followed, five pre-soaked wheat or oat grains being planted in each pot over agar inoculum disks 8 mm. in diameter, cut out with a cork borer from the margin of a colony of *Ophiobolus* growing on potato dextrose agar. The oat grains were dehulled before planting to increase percentage germination. After planting, the pots were randomized on the glasshouse bench, and watered once a week with the following nutrient solution:

Calcium nitrate ($Ca(NO_3)_2$)	0·8 g.
Potassium nitrate (KNO_3)	0·3 g.
Dihydrogen potassium phosphate (KH_2PO_4)	0·2 g.
Magnesium sulphate ($MgSO_4$, $7H_2O$)	0·2 g.
Potassium chloride (KCl)	0·2 g.
Ferric chloride ($FeCl_3$, $6H_2O$)	0·025 g.
Distilled water	1 litre

The plants from five pots of each series were washed out at fortnightly intervals from two to eight weeks, and pickled in 60% alcohol. The three oldest roots on each plant were examined under a binocular dissecting microscope (magnification, ×20) and the extent of growth of the runner hyphae measured (Garrett, 1936). The results for the first three samplings are given in Table I.

Table I. *Growth of fungus along the roots in mm.**

	W 1	W 2	W 3	O 3	O 4	O 13
After 2 weeks:						
On wheat	21 (±*1·4*)	29 (±*0·7*)	33 (±*1·4*)	15 (±*0·6*)	10 (±*0·5*)	19 (±*1·0*)
On oats	11 (±*1·2*)	4 (±*0·8*)	15 (±*1·3*)	8 (±*1·0*)	6 (±*0·4*)	8 (±*0·3*)
After 4 weeks:						
On wheat	40 (±*2·1*)	49 (±*4·2*)	45 (±*1·7*)	43 (±*2·7*)	25 (±*2·2*)	55 (±*2·9*)
On oats	14 (±*1·3*)	23 (±*2·8*)	45 (±*2·7*)	33 (±*3·3*)	24 (±*1·6*)	14 (±*1·2*)
After 6 weeks:						
On wheat	47 (±*2·0*)	50 (±*·25*)	41 (±*1·9*)	40 (±*2·8*)	31 (±*1·7*)	55 (±*2·7*)
On oats	30 (±*3·6*)	50 (±*·76*)	44 (±*3·4*)	35 (±*2·6*)	36 (±*2·9*)	40 (±*2·7*)

* The figures in brackets here, and in some subsequent tables, show the standard error.

The final sampling consisted of oats only; after washing out the plants, the tops were cut off about 1 cm. above the seed, and weighed.

Table II. *Weight of tops of oat plants, eight weeks old, inoculated with fungus isolates from wheat and oats*

	W 1	W 2	W 3	O 3	O 4	O 13
Mean fresh weight per plant in g.	3·4 (±*0·2*)	3·4 (±*0·2*)	3·6 (±*0·2*)	1·4 (±*0·1*)	0·8 (±*0·2*)	0·5 (±*0·2*)

The roots were not included in the examination, which comprised measurements both of extent of runner hyphae, and of length of root discoloured by infection; the figures are for the secondary roots formed at the first node.

Table III. *Infection of secondary roots of oat plants eight weeks old, inoculated with fungus isolates from wheat and oats*

	W 1	W 2	W 3	O 3	O 4	O 13
Mean hyphal growth in mm.	8 (±*1·3*)	28 (±*6·1*)	15 (±*4·3*)	39 (±*5·6*)	34 (±*2·9*)	24 (±*5·3*)
Mean length of root discoloured in mm.	1 (±*0·8*)	1 (±*0·8*)	1 (±*0·7*)	26 (±*4·0*)	28 (±*2·5*)	13 (±*3·6*)

The following conclusions were drawn from these results:

(1) Wheat was susceptible to isolates of *Ophiobolus* both from English wheat and from Welsh oats. The former (W 1, W 2 and W 3) produced the greater effect, many plants being killed after four to six weeks, but the type of infection and the appearance of the diseased plants were similar in all.

(2) Oats were highly resistant to the English isolates. Although runner hyphae had grown down the seminal roots for a considerable distance, the roots rarely showed any discoloration and were well developed. The secondary roots and subcoronal internode were generally free from hyphae, but in a few plants perithecia formed on the leaf bases.

(3) Oats were vigorously attacked by the Welsh isolates. O 13 was the most virulent, many plants being killed in six to eight weeks, and O 3 was the weakest. The root systems were poorly developed and severely attacked, both primary and secondary roots showing much discoloration.

Table I also shows that figures for the growth of runner hyphae of isolates from wheat and oats down the roots are not significantly different. Relying on this measurement alone, it would appear that oats are susceptible to all isolates used, but Tables II and III, giving weights of tops and extent of discoloration of the secondary roots, respectively, show that oats are seriously affected only by the isolates

from oats and are resistant to those from wheat. These observations indicate that, where different hosts are to be compared, infection is best estimated by the length of discoloured root; this figure may be supported by other data, such as the weight of tops of the plants.

Experiment II. Four varieties of oats, one of wheat, and one of barley were used in Experiment II, with the six isolates employed in Experiment I. The cereal varieties were Victory, New Abundance, and Scotch Potato white oats, Jubilee Black oats, Little Joss wheat, and Spratt Archer barley. There were thus thirty-six series, and four replicates of each were planted in ten-inch pots of sand with nutrient solution. Eight grains were sown over inoculum disks in each pot and seedlings thinned to five after ten days. After twelve weeks the tops were cut off and weighed.

Table IV. *Mean fresh weight in g. of tops of oat and wheat plants, inoculated with isolates from wheat and oats*

	W 1	W 2	W 3	O 3	O 4	O 13
Victory oats	11·8	11·4	13·4	9·3	7·6	7·7
New Abundance oats	11·0	13·7	12·4	8·2	5·0	6·8
Scotch Potato oats	12·3	11·0	10·6	7·7	7·0	9·5
Jubilee Black oats	11·7	12·0	10·2	6·2	2·5	11·1
Little Joss wheat	6·9	7·1	3·4	7·3	6·3	6·9
Spratt Archer barley	10·5	12·3	9·2	10·5	9·8	11·9

The roots were pickled in 2 % formaldehyde, and examined under the binocular microscope. The secondary roots only were considered, the primary roots having often disappeared. The total number of secondary roots, and number infected, were recorded for each plant; the percentage of infected roots for each series of twenty plants in four pots is given in Table V. These data show that the difference in

Table V. *Percentage infection of secondary roots of oat and wheat plants, inoculated with fungus isolates from wheat and oats*

Fungus isolate ...	W 1	W 2	W 3	O 3	O 4	O 13
Victory oats	6 (±*2·0*)	5 (±*2·8*)	9 (±*4·0*)	61 (±*6·3*)	91 (±*2·8*)	77 (±*13·3*)
Scotch Potato oats	3 (±*1·7*)	0	0	72 (±*9·8*)	71 (±*10·0*)	74 (±*7·6*)
Little Joss wheat	1 (±*1·0*)	58 (±*1·7*)	59 (±*6·9*)	10 (±*6·1*)	30 (±*15·8*)	35 (±*14·1*)
New Abundance oats	7 (±*2·4*)	2 (±*1·7*)	3 (±*2·0*)	97 (±*2·0*)	94 (±*3·3*)	72 (±*14·3*)
Jubilee Black oats	7 (±*2·6*)	4 (±*2·8*)	20 (±*14·9*)	79 (±*11·1*)	97 (±*2·4*)	73 (±*5·1*)
Spratt Archer barley	38 (±*13·0*)	25 (±*8·8*)	76 (±*1·7*)	27 (±*10·5*)	43 (±*10·5*)	21 (±*14·0*)

reaction of all four varieties of oats to the isolates from oats and to those from wheat is highly significant, thus confirming the findings of Experiment I. The differences in degree of attack on wheat and barley by the six isolates, on the other hand, scarcely appear to be significant, although a higher susceptibility of barley towards the isolates from wheat was suggested by the general appearance of the plants and the discoloration of the leaf bases.

Experiment III. This experiment was carried out in seven-inch pots of sand with a nutrient solution, later in 1938 with five new isolates, three from oats in Wales, O 20, O 21 and O 23, and two from wheat, W 4 and W 5. Three hosts were used, viz. New Abundance oats, Scotch Potato oats, and Little Joss wheat. There were thus fifteen series with six replicate pots per series; each pot was thinned to five plants. The pots were washed out after eight weeks, and the plants weighed and examined as before. The results are given in Tables VI and VII. These tables show that the new isolates behaved as those used in Experiments I and II, there being a sharp distinction in pathogenicity between the Welsh and English isolates. The three isolates from oats are seen also to differ amongst themselves, O 20 being the most virulent and O 23 attacking oats rather weakly, although its action on wheat is at least as strong as that of the other two oat isolates.

The oat isolates were again characterized by sparse development of runner hyphae on the outside of infected roots, as compared with that made by the wheat isolates. With the latter, the longitudinal extent of infection inside the root can generally be estimated by the extent of runner hyphal growth, the infection hyphae within the cells of the cortex seldom extending farther along the root than do the runner hyphae (Garrett, 1934, 1936). The isolates from oats, on the other hand, have greater powers of longitudinal spread inside the root, so that discoloration and infection may extend farther than the growth of runner hyphae on the outside of the root. Roots examined under the microscope, often showed runner hyphae entering the root and growing parallel to the surface in the subepidermal cells, cortical infection hyphae branching off in the usual way. This type of growth has been observed in wheat roots under certain conditions (Garrett, 1934), but it is much more usual in oat roots.

Experiment IV. In order to investigate further the respective host ranges of the isolates from wheat and oat, a series of nineteen common English pasture grasses was inoculated with isolates W 1, W 2, W 3, O 3, O 4 and O 13, respectively, in five-inch pots of sand with a nutrient solution. After eight weeks the extent of hyphal growth and of root discoloration was recorded, both for seminal and for crown roots. The results of this and of subsequent unpublished work, indicate that not one of these nineteen species of grass shows complete resistance even to the English isolates. In whatever way a disease rating was computed from these data, however, infection of the grasses by the Welsh isolates was both more intensive and more extensive than that by the English isolates. The complete data may be found elsewhere (Turner, 1939).

Table VI. *Mean fresh weight in g. of tops of oat and wheat plants, eight weeks old, inoculated with fungus isolates from wheat and oats*

Host	New Abundance oats					Scotch Potato oats					Little Joss wheat				
Isolate	W 4	W 5	O 20	O 21	O 23	W 4	W 5	O 20	O 21	O 23	W 4	W 5	O 20	O 21	O 23
Mean fresh weight	1·9	1·9	0·4	1·5	1·8	2·6	2·3	1·3	1·8	2·3	0·3	0·3	0·7	1·2	0·9
Number of dead plants	0	0	19	1	0	0	0	4	2	1	13	16	8	5	3

Table VII. *Percentage visible infection of seminal and crown roots of oat and wheat plants, inoculated with fungus isolates from wheat and oats*

Host	New Abundance oats					Scotch Potato oats					Little Joss wheat				
Isolate	W 4	W 5	O 20	O 21	O 23	W 4	W 5	O 20	O 21	O 23	W 4	W 5	O 20	O 21	O 23
Total number of seminal roots	132	141	109	122	118	144	137	134	143	143	145	146	112	133	145
Percentage visible infection	24	12	100	83	78	23	26	100	91	66	100	100	89	78	93
Total number of crown roots	150	157	81	145	107	210	174	184	156	177	147	148	103	133	182
Percentage visible infection	0	0	55	28	25	0	0	53	29	2	75	68	42	24	38

(*c*) *Pathological histology*

The course of infection of wheat roots by *O. graminis* has been followed in detail by Fellows (1928), Robertson (1932), and Garrett (1934). The chief characteristics of such infection are as follows: the invading mycelium is differentiated into coarse, dark-coloured runner hyphae, which grow down the outside of the roots, and more slender, hyaline infection hyphae, which branch off from these and enter the cells of the cortex. The hyphae penetrate the endodermis and invade the vascular tissues, which become severely discoloured; in these tissues, the hyphae tend to grow in a longitudinal direction. Hyphal penetration of the cell walls is frequently accompanied by the formation of highly characteristic callosities or lignitubers, first investigated by Fellows (1928). These outgrowths of the cell wall closely invest the invading hyphae, often extending some way into the cavity of the invaded cell, and sometimes appearing to prevent further growth of the enclosed hyphae. Lignitubers are frequently absent from cells invaded whilst still immature, and are generally strongest in cells infected after reaching maturity. In wheat roots eight or more weeks old, the hyphae sometimes disappear from the cells of the cortex, remaining only inside the vascular cylinder. The cortex, however, still shows obvious signs of disease, the cell walls being studded with persistent lignitubers.

The course of infection of oat and wheat roots by isolates W 4 and W 5 from wheat and isolates O 20 and O 21 from oats was followed in plants grown in sand and nutrient solution, and inoculated in the usual way under the seed; plants were washed out after ten days and subsequently at five-day intervals to fifty days. The external appearance of the plants and the extent of discoloration of the roots were noted, and the roots examined microscopically. Hand sections or whole roots were cleared in lactophenol, and stained with cotton blue. The degree of infection throughout the course of the experiment was somewhat variable in the different pots, some plants being very severely infected or completely killed after four or five weeks, while others, inoculated with the same isolate, remained almost unattacked. The more severely infected plants from all series were used for microscopical examination.

After twenty days, plants in six out of the eight series (the exception being oats inoculated with isolates W 4 and W 5, respectively) showed obvious signs of attack. The crown and leaf bases were blackened, and many of the plants were stunted. In this trial one of the isolates from oats, O 20, attacked wheat more vigorously, or at least more rapidly, than did isolates W 4 and W 5, causing very severe discoloration of the culm bases, and stunting of the root

system. At each sampling, from twenty days after planting to the final sampling after fifty days, the course of infection of wheat inoculated with all four isolates, and oats inoculated with isolates O 20 and O 21, was very similar. Penetration of the cortex had taken place in both hosts after ten days, being most evident in the proximal part of the root in contact with the inoculum disk. Hyphae were seen in the vascular tissue of wheat roots after ten days, and of oat roots after fifteen days; severe vascular discoloration was apparent after twenty days. Lignitubers were irregularly distributed throughout the infected roots of both hosts, being abundantly developed on the walls of some cells, and absent from others; their distribution could be correlated to some extent with the age of the cell when infected. The wefts of invading hyphae tended to develop into cones of mycelium, through progressive branching in the inner layers of the cortex. In older roots the lesions were no longer well defined, and infection was general throughout the cortex, though the distribution of hyphae was rather irregular. Most of the cortical cells were occupied by a few longitudinally running hyphae; here and there, however, cells were to be observed densely packed with transversely-running hyphae. Hyphae in the cortical cells of infected roots stained less deeply and became less healthy in appearance after six or seven weeks; the number of hyphae containing protoplasm steadily decreased as the plants aged. The lignitubers persisted, however, being more abundant in cells of wheat than in those of oat roots.

Infection of oat roots by the wheat isolates may now be described. In the early stages, infection followed a similar course to that by oat isolates, though less vigorous. After fifteen days, when there were abundant runner hyphae on the outside of the seminal roots, penetration had occurred at a few scattered points, and the hyphae had not penetrated inwards through more than two or three cell layers. After twenty days there were occasional lesions on the roots in which penetration was heavy and had extended to the endodermis. In a few roots, hyphae were seen at this stage inside the vascular cylinder, which showed some localized discoloration. Lignitubers were formed freely in many of the infected cells, though not in cells in the centre of lesions, and these appeared sometimes to have checked the spread of the hyphae. After twenty-seven days, the roots showed less obvious infection than after twenty days. Scattered groups of cells showed hyphae that appeared to be disintegrating, as indicated by their weakly staining properties and attenuated appearance, whilst other cells showed prominent lignitubers but no visible hyphae. Even in those taken after thirty-four and forty-one days, the roots still showed occasional localized lesions with persistent hyphae; occasionally penetration hyphae from the runner hyphae had branched in a single superficial cell until this was closely packed with stout coiled hyphae.

Amongst all samples examined from the experiment, crown root lesions were found only twice, although occasionally runner hyphae grew along the outside of these roots.

It therefore appears from these observations that the resistance of oat roots to isolates of *O. graminis* from wheat is of the chemical rather than the mechanical type (Brown, 1936).

(*d*) *Morphological and cultural characters of the isolates*

It was found impossible to distinguish the six Welsh isolates of *Ophiobolus*, obtained from oats, by their appearance in culture from typical isolates of *O. graminis* obtained from wheat. On the basis of colour and other colony characters on potato-dextrose agar, the isolates O 3–O 23 might all have been identified as *O. graminis*. Their growth rate was also comparable to that of isolates W 1–W 5 from wheat. A comparison of growth rate on a series of potato dextrose agars adjusted to different reactions from *p*H 4·0 to 9·0 showed that the oat isolates preferred if anything an initial reaction on the acid side of neutrality, whereas the wheat isolates grew best on a neutral or slightly alkaline medium. The range for suboptimal growth of both series of isolates was wide, however, and the differences were no greater than those obtained by Webb & Fellows (1926) in their study of the growth of several isolates of *O. graminis* on a number of different nutrient agars adjusted to a range of *p*H values.

Sharp differences were found, however, in ascospore measurements of the two series of isolates. Perithecia were obtained by Garrett's (1939) method, whereby agar-inoculated wheat seedlings were grown in boiling tubes half filled with sand plus inorganic nutrient solution, exposed to light in a north window of the laboratory. Perithecia generally matured in less than two months, on stems and especially on roots exposed to the light. The first series of tubes, containing wheat seedlings inoculated with isolates W 2, W 3, O 3, O 4 and O 13, respectively, was set up in March 1938. Measurements of the length of one hundred ascospores, taken from not less than five ripe perithecia, were made for each isolate (Table VIII).

Table VIII. *Ascospore measurements in μ*

	W 2	W 3	O 3	O 4	O 13
Mean length	86 (±*0·40*)	84 (±*0·31*)	116 (±*0·36*)	105 (±*0·27*)	110 (±*0·26*)
Modal length	90	84	118	108	112
Range in length	68–104	72–102	102–130	94–130	84–130
Mean number of septa	8·5	8·0	11·0	11·5	12·5

In the second series set up in February 1939, wheat and barley seeds were inoculated with isolates W 4 and W 5, and wheat and oat

seeds with isolates O 20, O 21 and O 23, respectively. The length of one hundred ascospores, taken from not less than five perithecia, was again measured; in the O isolates, measurements of ascospores from perithecia formed on two hosts may be compared (Table IX).

Table IX. *Ascospore measurements in* μ

	W 4	W 5	O 20	O 21	O 23
On wheat	80 ($\pm$*0·35*)	79 ($\pm$*0·29*)	104 ($\pm$*0·42*)	124 ($\pm$*0·43*)	117 ($\pm$*0·40*)
On oats	—	—	106 ($\pm$*0·41*)	117 ($\pm$*0·38*)	113 ($\pm$*0·39*)

The length of the ascus for different isolates on different hosts is given in Table X, which shows that this character differs as significantly as the length of the ascospore in the two series of isolates, but there is no consistent effect of host upon the length of the ascus.

Table X. *Ascus measurements in* μ

	W 4	W 5	O 20	O 21	O 23
On barley	103 ($\pm$*0·71*)	116 ($\pm$*1·0*)			—
On wheat	100 ($\pm$*0·57*)	112 ($\pm$*0·87*)	120 ($\pm$*1·22*)	138 ($\pm$*0·73*)	138 ($\pm$*0·56*)
On oats	—	—	128 ($\pm$*0·90*)	133 ($\pm$*0·59*)	131 ($\pm$*1·0*)

Measurements of the length of the ascospore were also made from naturally infected material. The length of one hundred ascospores, taken from at least five perithecia, was determined from three different collections of infected oat stubble, which subsequently gave isolates O 20, O 21 and O 23, respectively, in the autumn of 1938 (Table XI).

Table XI. *Ascospore measurements in* μ

	O 20	O 21	O 23
Mean length	101 ($\pm$*0·59*)	110 ($\pm$*0·52*)	117 ($\pm$*0·54*)
Modal length	99	115	115
Range in length	86–122	90–131	97–140
Mean no. of septa	10	12	12

Status of fungus from oats

The isolates from oats thus differ significantly from those from wheat in the length of the ascospore, as well as in host range. The two series of isolates are, however, very similar in cultural appearance and in the symptoms produced in susceptible hosts. Miss E. M. Wakefield has kindly confirmed the difference in ascospore length, and from this and the other characteristics considers that the isolates from oats should be regarded as a new variety of *O. graminis*.

Ophiobolus graminis Sacc. var. *Avenae* E. M. Turner a typo in longioribus sporis (101–117 μ) et in planta hospitali, *Avena sativa*, differt.

SUMMARY

Outbreaks of Take All in oats have often been reported in recent years from Wales, and occasionally from Australia, Denmark and Holland, although in most parts of the world it is commonly held that oats resist the disease. Isolates of *Ophiobolus* from oats grown in Wales were indistinguishable in cultural behaviour from *O. graminis*, but they were very pathogenic to oats, which were found to be highly resistant to ordinary *O. graminis*.

This histology of the infection of oat plants by the fungus from Wales and by *O. graminis* was studied in detail. It was found that there were significant differences between the two groups of isolates in the length and septation of the ascospores, the Welsh material giving a length of 101–117 μ, the English material 79–86 μ.

The fungus from Welsh oats is therefore regarded as a new variety, *Ophiobolus graminis* Sacc. var. *Avenae* E. M. Turner.

I have much pleasure in recording my grateful thanks to Mr S. D. Garrett, who suggested this problem and supervised the work, and to Miss E. M. Wakefield for her advice on the systematic status of the isolates of *Ophiobolus* from oats.

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NOMINA GENERICA CONSERVANDA

CONTRIBUTIONS FROM THE NOMENCLATURE COMMITTEE OF THE BRITISH MYCOLOGICAL SOCIETY. III

(Secretary: E. M. Wakefield)

Since the publication of the last contribution (these *Transactions*, xxiii, 1939, 281) the Committee has been enlarged by the addition of Dr G. C. Ainsworth.

The following statements set out the arguments for and against twelve more of the proposals for conservation of generic names of fungi which were published in the Supplement to the *International Rules*, 1935. The recommendations made are with one exception the unanimous opinion of this Committee. In the matter of *Agaricus* versus *Psalliota*, opinion was divided, and the majority recommendation is given.

The Committee regrets that in the statement on *Urocystis* versus *Tuburcinia* (*Trans. Brit. mycol. Soc.* xxiii, 1939, 223) an error was made with regard to Ciferri's genus *Ginanniella* (loc. cit., last sentence on the page). Dr Ciferri has pointed out that his genus was founded on the presence of a conidial stage, and that his diagnosis admits the presence of cortical cells in the spore-balls. This, however, does not affect the argument for the conservation of *Urocystis*.

Cordyceps (Fr.) Link

On p. 121 of *International Rules* there is a proposal to conserve "*Cordyceps* Fr. Summ. Veg. Scand. (1849) 381.—T.: *C. militaris* Fr. l.c." against "*Cordiceps* Link, *Handb.* iii (1833) 347". [The page reference should be "346".]

This proposal is apparently based on a mistake by Winter in *Rabenhorst Kryptogamen-Fl. Deutschl.* i, ii, 148–50 (1885), where "*Cordiceps* Link (*Handbuch*, iii, 347)" is cited in the synonymy of four species. But Link in *Handbuch*, iii, 346 used the same spelling, *Cordyceps*, which everyone else uses. The generic name is *Cordyceps* (Fries [ut "Trib." sub *Sphaeria*, *Syst. Mycol.* ii, ii, 323, 1823]) Link (1833), and is accordingly in no need of conservation.

Recommendation. The proposal to conserve *Cordyceps* (Fr.) Link against "*Cordiceps* Link" should be rejected as unnecessary.

Dubitatio Speg. (1881) versus *Spegazzinula* Sacc. (1883)

The proposal published in the Appendix to the *International Rules*, 1935, is to conserve *Spegazzinula* Sacc. *Syll.* ii, 537 (1883) against *Dubitatio* Speg. *Fung. Arg. Pug.* iv, no. 202 (1882).

Dubitatio Speg. in *Anal. Soc. Cientif. Argentina*, xii, 212 (p. 77 of reprint) (1881).

Spegazzini proposed *Dubitatio dubitationum* gen. et sp. nov. There was and is

no rule to prevent the use of *Dubitatio* as a generic name, and *D. dubitationum* is not a tautonym, as the specific epithet does not exactly repeat the generic name (see, for example, *Barbarea Barbareae*, *J. Bot., Lond.*, LXIII, 183 (1925)).

Spegazzinula Sacc. in *Syll. Fung.* II, 537 (1883).

Saccardo stated (wrongly) that *Dubitatio* was "nomen prorsus exlex", proposed *Spegazzinula* nom.nov. in its place, and made the combination *S. dubitationum* (Speg.) Sacc. This was the only known species until 1903, when *S. juglandina* von Höhn. was described. No other species is recorded up to 1928.

The name *Spegazzinula* was accepted by Clements & Shear, *Gen. Fungi.* They do not mention *Dubitatio*, but von Höhnel accepted it in his later publications, since he wrote "*Dubitatio* (=*Spegazzinula*)" in *Fragmente* nos. 391 and 604.

Recommendation. Dubitatio is a valid name, validly published, and it seems unnecessary to conserve the later *Spegazzinula* for two little-known species.

Daldinia Ces. & de Not. (1863) versus *Perisp[h]aeria* Rouss. (1806), *Perispherostoma* Gray (1821) and *Hemisphaeria* Klotzsch (1843)

Species of *Daldinia* are characterized by their phaeosporous ascospores and by the internal zonation of their stromata, a feature which distinguishes them at sight from the subglobose species of *Hypoxylon* of which they are a segregate. This character was plainly observed and figured by Bolton in 1791, and suggested to him the specific epithet of his *Sphaeria concentrica*, but generic significance was not attributed to it until 1863, when Cesati and de Notaris incorporated it in the diagnosis of *Daldinia* as "stroma intus transverse concentricum".

Daldinia Ces. & de Not. in *Comm. Soc. Critt. Ital.* I, 197 (1863).

The genus was published with two species, *D. concentrica* (Bolt. ex Fr.) Ces. & de Not., and *D. vernicosa* (Schwein.) Ces. & de Not. The first was much the better known to the authors and may be accepted as the type. The genus is well known and is universally accepted in all systematic works and text-books.

The other genera under discussion are derived directly or indirectly from Persoon's section of *Sphaeria*, "Periphericae", which was established to take all species that have cushion-shaped stromata, with peripheral perithecia: it took no account of their ascospore characters. Its thirteen species, in Saccardo's terminology, were *Daldinia concentrica* (first), seven species of *Hypoxylon*, *Hypocrea gelatinosa* and *H. rufa*, *Melogramma vagans*, *Plowrightia ribesia* and *Dothidea Sambuci*.

Perisp[h]aeria Rouss. *Fl. Calvados*, 42 (1806) and *Perispherostoma* Gray, *Brit. Pl.* I, 513 (1821).

Both these genera are based directly on Persoon's section "Periphericae"; in both, *Daldinia concentrica* heads the list of species; in neither is the concentric zonation of its stromata considered as more than a specific character, and the ascospore characters are not considered at all. Both genera are invalid because pre-*Systema*, and neither would clash with *Daldinia*, unless its first species were arbitrarily selected as the type. Neither has been taken up, and there appears no reason why either should be.

Hemisphaeria Klotzsch in *Nova Acta Leop. Carol.* XIX, Suppl. I, 241 (1843).

The genus was published by Klotzsch, but attributed by him to Nees in *Systema*, 290 (1817). Nees, however, did not propose *Hemisphaeria* as a genus, but proposed a "Halbkugelsphärien Sphaeriae Hemisphaericae" as a section of *Sphaeriae*, which covered the same ground as Persoon's section "Periphericae". Again *Daldinia concentrica* was the first species mentioned.

Klotzsch published a generic diagnosis, in which the stromata were characterized by the peripheral perithecia, but restricted the genus to species with phaeosporous

ascospores. He did not make the zonation of the stromata a generic character, and hence did not intend to exclude the main mass of species of *Hypoxylon* that have cushion-shaped stromata. The only species he mentioned was *Hemisphaeria concentrica* which accordingly must be the type species.

The genus *Hemisphaeria* Klotzsch has never been taken up, but it was validly published. As it antedates *Daldinia* and has the same type species, it provides the nomenclaturally correct name for that genus.

Recommendation. As the name *Daldinia* is universally recognized and accepted, and the earlier *Hemisphaeria* is virtually unknown, and has never been taken up, it is recommended that *Daldinia* Ces. & de Not., type species *D. concentrica* (Bolt. ex Fr.) Ces. & de Not., be conserved against *Hemisphaeria* Klotzsch.

The names *Perisphaeria* Rouss. and *Perispherostoma* Gray are invalid and need not be conserved against.

Note. In the published proposal, *Cercidospora* Körber was included by a printing error as a synonym of *Daldinia*. It really clashes with *Didymella*.

Hypospila Fr. (1825), *Hypospila* Karst. (1873) and *Phoma* Fr. (1823)

The proposal before the Congress (*International Rules*, 1935, p. 121) is to conserve *Hypospila* Fr. [*Syst. Orb. Veg.* (1825?), 109] *Summ. Veg. Scand.* (1849), 421, with type *H. pustula* (Fr. *Syst. Mycol.* II, 547, sub *Phoma*) Karst. *Mycol. Fenn.* 127 against *Phoma* Fr. *Syst. Mycol.* II (1822), 546. The proposal is complementary to the proposal to conserve *Phoma* Desm. non Fr. which was examined in *Trans. Brit. mycol. Soc.* XXIII, 289 (1939).

Phoma Fr. *Novit. Flor. Suec.* 80 (1819) and *Syst. Mycol.* II, ii, 546 (1823).

When he proposed the genus in 1819, Fries specified *Sphaeria pustula* Pers. as type. As already stated (loc. cit.) it is an Ascomycete. In 1823 he included (1) *Phoma saligna* (now placed in *Linospora*—another Ascomycete), (2) *P. Populi* and (3) *P. filum* (both uncertain), (4) *P. pustula*, and (5) *P. tularostoma* (compiled by Saccardo as *Phoma*).

Hypospila Fr. *Syst. Orb. Veg.* 109 (1825).

Fries described *Hypospila* as an Ascomycete, "Typus est *Spiloma inustum* Ach." Part of Acharius's type specimen of *S. inustum*, from Sierra Leone, was found by Petrak & Sydow (*Ann. Mycol.* XXI, 370, 1923) to have no definite fungus structure. Hence they claimed that the name *Hypospila* Fr. should be rejected.

In *Summ. Veg. Scand.* II, 421 (1849) Fries again listed *Hypospila* with *H. inusta* as type, but placed in it also "*H. quercina* s. *bifrons*" (later made the type of the genus *Hypospilina* Trav.) and "*H. populina* s. *ceuthocarpa*" (which was made the type of *Ceuthocarpon* Karst.). He still maintained *Phoma* Fr., with four species, including *P. pustula*.

Karsten in *Mycol. Fenn.* II, 127 (1873) transferred *Phoma pustula*, the type of the genus *Phoma* Fr., to *Hypospila*. Saccardo in *Syll. Fung.* II, 189 (1883) followed Karsten and placed *H. pustula* as the first species of *Hypospila*. Most mycologists subsequently have considered this the "typical" species. Only eleven species of *Hypospila* have been compiled in the *Sylloge*. Only *H. pustula* is included in *Hypospila* by Traverso in *Flora Italica Crypt.* Fasc. 2, 346 (1906).

Von Höhnel in 1918 (*Ann. Mycol.* XVI, 97) proposed the monotypic genus *Chalcosphaeria* for *H. pustula*.

The pith of the proposal is to replace the real type species of *Hypospila* Fr. (*H. inustum*) by *H. pustula* (Fr.) Karst.; that is, to make a new genus *Hypospila* Karst., and to conserve it against *Hypospila* Fr. (1825) and *Phoma* Fr. (1823).

Recommendation. It has already been recommended (loc. cit.) that *Phoma* Desm. be conserved against *Phoma* Fr. If this is accepted it becomes unnecessary to

conserve *Hypospila* Karst. against *Phoma* Fr. As however the name *Hypospila* has been so confused, and includes so few species, none of which is of economic importance, it is recommended that a genus *Hypospila* Karst. be not erected, and that the genus *Chalcosphaeria* von Höhn., type species *C. pustula* (Fr.) von Hohn., be accepted.

MASSARIA de Not. (1844) versus *Splanchnonema* Corda (1829)

Massaria de Not. in *Giorn. bot. ital.* I, 333 (1844).

De Notaris characterized his genus as having simple perithecia which collapse when dry, and large asci which contain ovate, trilocular [i.e. bi-septate], coloured ascospores, each enclosed in a layer of mucilage.

The genus was monotypic, being based on "*Massaria inquinans* de Not.—*Sphaeria inquinans* Tode", and in an expanded form has been generally accepted by mycologists. Unfortunately "*Massaria inquinans* de Not.", which has ovate, or better, obovate, 2-septate ascospores, is distinct from *S. inquinans* Tode ex Fr. which has oval 3-septate ascospores. The latter is often cited as "*Massaria inquinans* (Tode ex Fr.) Fr." As the genus is now used, it includes all the species with phaeo-phragmospores, and hence both Tode's species, and that of de Notaris.

In Saccardo's *Sylloge*, III, p. 3, "*M. inquinans* de Not." is cited as a synonym of *M. loricata* Tul., which in turn is held to be barely distinct from *M. foedans* (Fr.) Fr.

It is submitted that the type species of the genus is correctly cited as "*Massaria inquinans* de Not., nec *Sphaeria inquinans* Tode ex Fr."

Splanchnonema Corda in Sturm, *Deutschl. Flora*, III, ii, 115 (1829).

The genus was based on *S. pustulatum* Corda, the fruit bodies of which were said to occur between bark and wood as felty elevations filled with yellowish asci containing three-celled ascospores. Corda thought that his fungus lacked both perithecia and stromata.

The genus was misconceived by Corda, and remained unused, although a number of writers commented on the resemblance between *Splanchnonema pustulatum* and *Massaria foedans*. In 1898, O. Kuntze (*Rev. Gen. Pl.* III, 530) accepted as a fact that they were identical, and hence that *Splanchnonema* Corda was the valid name of *Massaria* de Not. He accordingly transferred all the species, but has not been followed by anyone else.

Recommendation. As *Massaria* has been accepted since its foundation, and *Splanchnonema* has been taken up only by O. Kuntze, it is recommended that *Massaria* de Not., 1844, type species "*M. inquinans* de Not. nec *Sphaeria inquinans* Tode ex Fr.", be conserved against *Splanchnonema* Corda (1829).

TEICHOSPORA Fuckel (1869), *Strickeria* Körber (1865) and *Sphaeria* Fries (1823)

The proposal is to conserve *Teichospora* Fuck. *Symb. Mycol.* 160 (1869) against *Strickeria* Körb. *Parer.* 400 (1865) and *Sphaeria* Fr. *Syst. Mycol.* II, 319 (1823) emend. de Not. *Comm. Soc. Critt. Ital.* IV, 220, pro maxima parte (1863).

Teichospora Fuck. *Symb. Mycol.* 160 (1869).

The genus *Teichospora* was founded by Fuckel for Pyrenomycetes with simple, superficial perithecia and yellowish, muriform ascospores. He described five species and named *T. trabicola* as his type. Later (in *Nachträge*, I, 350) he described a further three species. The genus has been accepted by Saccardo, *Syll.* II, 290 (1883), who compiled thirty-three species. The genus has also been accepted by Ellis & Everhart, *North Amer. Pyrenomycetes*, 212 (1892); Berlese, *Icon. Fung.* II, 44 (1895); and by Clements & Shear, *Genera of Fungi*, 276 (1930) with *T. obducens* (Fr.) as the type.

Strickeria Körb. *Parer.* 400 (1865).

Strickeria was founded on *S. Kochii* Körb. The spores were described as coloured but no septation was mentioned, and the fructification was described as an apothecium. Rehm (in *Hedwigia*, XVIII, 113, 1879) demonstrated that *Teichospora* Fuck. is synonymous with *Strickeria* Körb. Winter (in Rabenh. *Kryptogamen-Fl. Deutschl.* II, 281, 1885) stated that he agreed with Rehm and drew attention to the fact that the ascospores of authentic material are muriform. He therefore adopted the genus *Strickeria* and cited seventeen species. This genus has also been accepted by Lindau in Engler & Prantl, *Nat. Pflanzenfam.* I, 416 (1897); Migula, *Kryptogamen-Fl. Deutschl.* III, 233 (1913); Lind, *Danish Fungi*, 198 (1913); Schroeter, *Die Pilze Schlesiens*, II, 332 (1908); and by Kirschstein in *Kryptogamen-Fl. Mark Brandenburg*, VII, ii, 265 (1911).

Sphaeria Fr. *Syst. Mycol.* II, 319 (1823) emend. Ces. & de Not. *Comm. Soc. Critt. Ital.* IV, 220, pro maxima parte (1863).

The genus *Sphaeria* has included the whole of the Pyrenomycetes. Cesati & de Notaris (loc. cit.) restricted it to include only species which possess superficial or partly sunken perithecia and three to many septate, dark-coloured ascospores. In Saccardo's *Sylloge* it was reserved for the residue of *Sphaeriaceae imperfecte cognitae*. Although under Art. 51 of the *International Rules* the name *Sphaeria* should have been preserved as a valid name for a section of the original genus, it has been applied to such diverse groups of species, and has been omitted for so many years from all mycological works, that it would be most undesirable for it to be restored in the restricted sense of Cesati & de Notaris.

Recommendation. As *Strickeria* provides both the first validly published name and also the most widely used name for the genus, it is recommended that the proposal to conserve *Teichospora* against it be rejected, and that *Sphaeria* Fr. emend. Ces. & de Not. be not restored.

DOTHIDELLA Speg. (1880) and *Plowrightia* Sacc. (1883)

The published proposal is to conserve *Plowrightia* Sacc. against *Dothidella* Speg. "*An. Soc. Sc. Argent.* XI (1881) 69".

Plowrightia belongs to the Dothideae, i.e. its stromata are erumpent. *Dothidella* was for many years accepted as a member of the Phyllachorae, which have immersed stromata. In 1915 Theissen & Sydow nominated as type species *Dothidella achalensis* Speg., a species with erumpent stromata, and this in effect transposed *Dothidella* into an earlier name for *Plowrightia*. Both genera have hyaline two-celled ascospores.

Dothidella Speg. (1880).

The name *Dothidella* first appeared in a table entitled "Nova Systematis Carpologici Dispositio" on an unnumbered page following p. 176 (p. 192 in reprint) of "Fungi Argentini. Pugillus primus" in *Anal. Soc. Cientif. Argentina*, IX (1880). Of the eight genera there accepted as belonging to the Dothideaceae, *Scirrhia* Nits., *Euryachora* Fuck. and *Dothidella* Speg. were tabulated as Hyalodidymae. A footnote ran "*Dothidella* Sp[eg]. Est *Dothidea* sporidiis hyalinis donata". This is not enough description for the precise recognition of the genus, since *Dothidea* is the only representative of Dothideaceae-Phaeodidymae in his table. No species was mentioned, and it is evident that the genus was not validly published in this place.

Later in the same year, in "*Fungi Argentini.* Pugillus secundus", *Anal. Soc. Cientif. Argentina*, X, 21 (1880), Spegazzini described a single species, *Dothidella australis*, on living leaves of *Solanum*. It is submitted that in accordance with Art. 43 this description validated the name *Dothidella*, and *D. australis* is therefore the type species of the genus.

D. *australis* was followed by "*Dothidea? Lorentziana*", described briefly without

characters of asci and spores, which were deficient because immature. From this it may be concluded that Spegazzini at this time was using the name *Dothidea* not only for Dothideaceae-Phaeodidymae, but also for Dothideaceae-Incertae.

In "Pugillus quartus" *Anal. Soc. Cientif. Argentina*, XII, 69–70 (1881), Spegazzini described *Dothidella achalensis, D.? gracilis* and *D. Hieronymi*. Having found the ascospores of *Dothidea Lorentziana*, and that they were hyaline and one-septate, he transferred it to *Dothidella* with a new diagnosis. In 1908 he transferred *Dothidella Hieronymi* to *Plowrightia*.

Saccardo, *Syll. Fung.* II, 627 (1883) compiled *Dothidella* with the remark "Est quasi *Phyllachora* hyalodidyma".

When Theissen & Sydow, *Ann. Mycol.* XIII (1915), monographed the Dothideales under 140 genera, they transferred *Dothidella australis* and *D. Lorentziana* to their genus *Placostroma* in the "Phyllachoraceae". They were able to redescribe *Dothidella australis*, presumably from the Exsiccata which they cite, "Speg. Decad. Myc. Argent. n. 42". It should be noted that *D. australis* was the only one of Spegazzini's first five species which they were able to study from authentic material.

Theissen & Sydow would no doubt have chosen *D. australis* as the type of *Dothidella* had they not overlooked the fact that it is the first species described; for they argue (p. 307) that the genus should be based on the first species, which they erroneously state to be *D. achalensis* Speg. They did not see a specimen of this species, but considered that the description made it clear that it belonged in their "Dothideaceae", and was a *Plowrightia*. They therefore placed *Plowrightia* as a synonym of *Dothidella*.

Spegazzini himself never considered *Plowrightia* a synonym of *Dothidella*. As mentioned above, he transferred *D. Hieronymi* to *Plowrightia*, and he described new species of *Plowrightia*, one as late as 1919, four years after Theissen & Sydow's monograph.

The name *Dothidella* is then an earlier name for *Placostroma*, or perhaps a *nomen ambiguum* through its incorrect use in the standard work on the Dothideales.

Plowrightia Sacc. in *Syll. Fung.* II, 635 (1883).

Plowrightia Sacc. is the correct name for the erumpent, hyalodidymous Dothideae compiled by Theissen & Sydow erroneously under *Dothidella*. *Plowrightia ribesia* (Pers. ex Fr.) Sacc. is the type.

Recommendation. It is recommended that *Dothidella* Speg. be held to have been first validly published in "Fungi Argentini. Pugillus secundus" (1880). From that it will follow that *D. australis* Speg. must be accepted as its type species, that *Dothidella* belongs to the Phyllachorae, that it accordingly does not clash with *Plowrightia* of the Dothideae, and that the proposal to conserve *Plowrightia* is unnecessary.

PSEUDOGRAPHIS Nyl. (1855) versus *Krempelhuberia* Massal. (1854)*

The published proposal reads: under Nomina conservanda, "*Pseudographis* Nyl. Essai Nouv. class. Lichens in: *Mém. Soc. Sc. Nat. Cherbourg*, II (1855) 190.—T.: *P. elatina* (Fr. *Syst. Mycol.* II, 584, sub Hysterio) Nyl. *Herb. Mus. Fenn.* 96". Under Nomina rejicienda, "*Krempelhuberia* Massal. *Esam. Lich.* (1854) 34". Various corrections are made below.

Krempelhuberia Massal. in *Geneacaena Lich.* 14 (1854).

The genus was founded on one species, *Krempelhuberia Cadubriae*. This name has apparently never been taken up by lichenologists or mycologists. Saccardo, *Syll. Fung.* II, 769 (1883), placed *K. Cadubriae* Massal. as a synonym of *Pseudographis elatina*, and subsequent authors have accepted this.

* With the co-operation of Mr I. M. Lamb, British Museum (Natural History).

Pseudographis Nyl. in *Mém. Soc. Sci. Nat. Cherbourg*, III, 190 (1855).

Nylander proposed the genus *Pseudographis*, based on *Lichen elatinus* Acharius (1798) (=*Hysterium elatinum* (Ach.) Pers. 1801), and made the combination *Pseudographis elatina*. He used the same combination in later publications (including *Herb. Mus. Fenn.* 96, 1859) but in 1857 he remarked in his "Enum. gén. Lichens": "*Pseudographis* Nyl. Potius fungus". Since about 1860 lichenologists and mycologists have agreed that *P. elatina* is a fungus, and *Pseudographis* has been accepted in mycological literature for eighty years. The type species may be cited as *P. elatina* (Ach. ex Fr.) Nyl. A dozen species have been described.

Recommendation. As the name *Krempelhuberia* Massal. (1854) has not been accepted, whereas *Pseudographis* Nyl. (1855) has received general acceptance as a fungus, it is recommended that *Pseudographis* be conserved against *Krempelhuberia*.

Hexagonia Poll. (1816), *Hexagona* Fr. (1836–8) and *Scenidium* (Kl.) O. Kuntze (1898)

The proposal published in the *International Rules*, 1935, p. 123, is to conserve "*Hexagona* Fr. *Epicr.* (1836–8) 496 [non *Hexagonia* Poll. Pl. nov. (1819) 35]—type: *H. apiaria* Fr. l.c. 497" against "*Scenidium* [Klotzsch, *Linnaea*, VII (1832) 200, subgen.] O. Kuntze *Rev.* II (1893), 515".

The date of Pollini should have been 1816 and that of O. Kuntze 1898. It is necessary to consider also the genus *Favolus*, since, as will be seen, the nomenclature of these two genera has been much confused. Most mycologists at the present time accept the two genera in the sense of Saccardo's *Sylloge*, VI. *Hexagonia* or *Hexagona* (the spelling varies) is used for corky or woody fungi of polyporaceous affinity which have large, more or less hexagonal pores, resembling the cells of a honeycomb. *Favolus* on the other hand is applied to fleshy or membranaceous species, which also have rather large, polygonal pores, but in which the pores are as a rule elongated radially, so that there is a suggestion of anastomosing lamellae.

Favolus Pal. ex Fr. *Syst. Orb. Veg.* 76 (1825).

The genus *Favolus* was first proposed by Palisot de Beauvois in his *Flore d'Oware et de Benin*, I, tab. I (1805), and was defined as follows: "Substantia coriacea, suberosa, latere sessilis aut subsessilis, subtus plicata: Plicis subregularibus, plerumque hexagonis, alveolatim reticulatis, apium favum simul imitantibus." Only one species was mentioned at that time, *F. hirtus* Pal., which is therefore the type of the genus. This species is of woody consistency and belongs to the later genus *Hexagona* Fr. For this reason, Murrill, in the *North American Flora*, transferred all the species of *Hexagona* to *Favolus* and vice versa (see also below under *Hexagonia* Poll.). Later, in 1809 and 1819? (for dates of the parts of Palisot's *Flore* see *Proc. Amer. Phil. Soc.* LXXVI, 918, 1936), Palisot added the species *F. tenuiculus* and *F. glaber*, of which the former is a *Favolus* as now understood. In 1825 (*Syst. Orb. Veg.* 76) Fries took up Palisot's genus in the mixed sense, including species of both *Hexagona* and *Favolus*, but in 1828 (*Elenchus*, I, 44) he limited the genus *Favolus* to non-woody species, thus excluding Palisot's type, and cited as example *F. brasiliensis* Fr. By so doing he in effect created a genus *Favolus* of his own, with type *F. brasiliensis*. *Favolus* Fr. (1828) was taken up by Saccardo and is used by most mycologists.

Hexagonia Pollini *Horti et provinciae veronensis plantae novae*, 35 (1816).

Pollini's genus, defined as "Pileus subtus in cellulas hexagonas exfossus", was based on the single species *Hexagonia Mori* Poll., which is now regarded as a synonym of *Favolus europaeus* Fr.

Hexagona Fr. *Epicrisis* 496 (1836–8).

Fries attributed the genus *Hexagona*, spelt without an *i*, to Pollini, and included Pollini's type species, *Hexagonia Mori*, which he did not know. The majority of the species listed by him, however, of which the first was *H. Wightii* (Kl.) Fr., were polyporoid forms with more or less woody texture. He kept *Favolus* distinct, and mentioned that both *Hexagona* and his *Favolus* were included by Palisot under *Favolus*.

Scenidium (Kl.) O. Kuntze *Rev. Gen. Pl.* III, ii, 515 (1898).

Scenidium was a name proposed by Klotzsch in *Linnaea*, VII, 200 (1832) for a "tribe" of *Polyporus*, characterized by having seta-like growths on the pore walls. The type was *Polyporus Wightii* Kl., but Klotzsch never used *Scenidium* as a generic name and made no combinations. In 1898 Kuntze pointed out that *Hexagona* Fr., was not the same as Pollini's genus *Hexagonia*, since the type of the latter, *H. Mori*, was a species now regarded as belonging to *Favolus*. He therefore maintained that Fries's genus should be renamed, and for this purpose raised Klotzsch's tribe *Scenidium* to generic rank. The name has not been used by any later mycologist.

Discussion.

Since according to our present Rules the nomenclature of the Hymenomycetes begins with Fries, *Syst. Mycol.* I (1821), there is no need to conserve *Hexagona* Fr. against the later *Scenidium* (Kl.) O. Kuntze. There remains, however, the question of the spelling, *Hexagonia* or *Hexagona*. *Hexagonia* has been used by Saccardo, *Syll. Fung.* VI (1888); McAlpine, *Australian Fungi* (1895); Killermann in Engler & Prantl, *Nat. Pflanzenfam.* ed. 2, VI (1928); Clements & Shear, *Genera of Fungi* (1931). On the other hand *Hexagona* has been used by Lloyd, *Syn. Gen. Hexagona* (1910); Bourdot & Galzin, *Hyménomycètes de France* (1928); Shope, *Polyporaceae of Colorado* (1931); Konrad & Maubl. *Icon. Sel. Fung.* (1924–37).

Although the omission of the *i* by Fries may have been an unintentional error, as stated in the examples under Art. 70 of the Rules, it would appear desirable to adopt this spelling in order to emphasize that the genus as at present understood is not based on the plant to which Pollini gave the name *Hexagonia*. If the first species from Fries's first section be chosen as lectotype, his conception of the genus will be preserved. *Hexagona Wightii* (Kl.) Fr. (non *Wrightii*) is therefore suggested as lectotype; this species is probably identical with *Polyporus apiarius* Pers., the species suggested as type in the published proposal.

Recommendation. It is recommended that the proposal to conserve *Hexagona* Fr. (1836–8) against *Scenidium* (Kl.) O. Kuntze (1898) be rejected as unnecessary. It is further recommended that the name of the genus be spelt *Hexagona*, not *Hexagonia*, and that *H. Wightii* (Kl.) Fr. be chosen as lectotype.

AGARICUS Linn. ex Fr. (1821) versus Psalliota (Fr.) Quél. (1872) and Pratella (Pers.) S. F. Gray emend. Gill. (1874)

The proposal published in the Supplement to the *International Rules*, 1930, is to conserve *Agaricus* Fr. *Syst. Mycol.* I (1821), 8, emend. Karst. *Hattsv.* I (1879), 482 against *Psalliota* Quél. *Champ. Jura et Vosges*, I (1872), 107 and *Pratella* Gill. *Hym. France* (1874), 559.

The converse proposal, to conserve *Psalliota* Quél. against *Agaricus* Fr., was made by the late Professor Jaczewski in a list which was sent in too late for inclusion with the other proposals in the Rules. It was published by Briquet in his *Rec. Syn.* 1930, p. vii.

Agaricus Linn. ex Fr. *Syst. Mycol.* I, 8 (1821).

The name *Agaricus* was taken up by Fries in the sense of Linnaeus, *Sp. Plant.* ed. 1, 1753, but was confined by him to fleshy gill-fungi, whereas Linnaeus had included certain more or less woody species.

Fries divided *Agaricus* into a number of "tribes", which have since been used as genera and are frequently attributed to him in this rank, though illegitimately. Quélet (loc. cit.) seems to have been the first to use the Friesian sections as genera. Now Art. 51 of the Rules lays it down that when a genus is divided into two or more genera, the generic name must be retained for one of them, or (if it has not been retained) must be re-established. The genus for which it is retained must be that which contains the original type species, or a lectotype, which must be chosen. According to the Rules therefore the name *Agaricus* should have been retained for something, but its application must be decided according to what is selected as the type species of *Agaricus* Linn. ex Fr.

The name *Agaricus* goes back to early times, and was applied to woody fungi such as *Daedalea quercina* and *Fomes officinalis*, but this need not be considered. Linnaeus (loc. cit.) defined *Agaricus* and divided it into two sections, the first, with twenty-four species, containing the fleshy stipitate Agarics, and the second containing three dimidiate species, namely the fungi now known as *Daedalea quercina*, *Lenzites betulina*, and *Schizophyllum commune*. In Fries's classification only the first of these sections was included in *Agaricus*, so that it is advisable to select as type of *Agaricus* Fr. (1821) a species which Linnaeus included in the first (stipitate) section. *Agaricus campestris* may be selected as lectotype. It is common, is of economic importance, and was known from very early times. If this is done, then *Agaricus* becomes the valid name, according to the Rules, for the genus which includes *A. campestris* Linn.

In this sense *Agaricus* has been used by Karsten, *Hattsv.* I, XXV and 482 (1879); Saccardo, *Syll. Fung.* V, 993 (1887) and *Flora Ital. Crypt.* I, Fasc. 15 (1916); Massee, *British Fungus Flora*, I, 409 (1892); Patouillard, *Hym. d'Europe*, 121 (1887) and *Essai Taxon.* 173 (1900); Konrad et Maubl., *Icon. Sel Fungor.* (1924–37); R. Singer, "Das System der Agaricales" in *Ann. Mycol.* XXXIV, 340 (1936); also by Murrill in various papers in *Mycologia*, etc.

Pratella (Pers.) S. F. Gray (1821) emend. Gillet, *Hyménomycètes* (1874).

Pratella was used by Pers. *Syn.* (1801) as the name of a section of *Agaricus* which contained both purple- and brown-spored forms. It was first used as a generic name by S. F. Gray, *Nat. Arr. Brit. Plants*, I, 626 (1821), who included various purple-spored agarics (e.g. *Psalliota*, *Hypholoma* and *Stropharia* spp.). Gillet (loc. cit.) limited *Pratella* to the mushroom genus. The name has not been used by any recent mycologist.

Psalliota (Fr.) Quél. *Champ. Jura et Vosges*, I, 107 (1872).

Fries used the name *Psalliota* as that of a tribe or subgenus for the group of purple-spored agarics including *Agaricus campestris*. Quélet in 1872 (loc. cit.) dropped the name *Agaricus* entirely, and elevated all the subgenera of Fries to the rank of genus. He has been followed in the use of *Psalliota* by Kauffmann, *Agaricaceae of Michigan*, 232 (1918); Ricken, *Die Blätterpilze*, 235 (1915); Rea, *British Basidiomycetae* (1922); Ramsbottom, *Handbook of the Larger British Fungi* (1923); Lange, *Flora Agaricina Danica*, IV, 53 (1939); Buller, *Researches on Fungi* (1909–34); Bisby *et al.*, *Fungi of Manitoba and Saskatchewan* (1939). Further, the more recent editions of certain textbooks, such as Strasburger, *Textbook of Botany*, and Scott, *Structural Botany*, have adopted *Psalliota* in place of *Agaricus* of the earlier editions for the name of the common mushroom. The *Review of Applied Mycology* has used *Psalliota* for the past ten years.

Discussion.

There is no doubt that the name *Agaricus*, according to the current Rules, ought to have been retained when the group was divided, and there seem to be good reasons for applying it to the genus containing *Agaricus campestris* Linn. ex Fr., which may be chosen as lectotype. On the other hand, chiefly owing to the use of works such as Ricken's *Blätterpilze* and Rea's *Basidiomycetae*, the name *Psalliota* has come into very general use in recent years, and is now found even in academic

textbooks. Rea uses the name *Psaliota*, but the current edition of Liddell & Scott gives ψαλλιον as the preferable Greek form; from this it would seem that *Psalliota* is the better spelling. It is open to question if it is advisable to insist on the use of the valid name *Agaricus*.

Recommendation. The majority opinion of this committee is that *Agaricus* should be typified by *Agaricus campestris* Linn. ex Fr. *Agaricus* Linn. ex Fr., with the date from 1821, will then be the valid name for the genus that includes the common mushroom, and need not be conserved against either *Psalliota* (Fr.) Quél. (1872) or *Pratella* (Pers.) S. F. Gray emend. Gillet (1874).

SEPTORIA Sacc. (1884) versus *Septoria* Fr. (1828)

The proposal published in the Supplement to the *International Rules*, 1935, is to conserve *Phleospora* Wallr. *Crypt. Germ.* 176 (1833) against *Septoria* Fr. *Syst. Mycol.* III, 480 (1832), emend. O. Kuntze, *Rev. Gen. Pl.* III, ii, 520 (1898). Actually, however, Kuntze employed not *Septoria* but *Septaria* Fr., *Nov. Fl. Suec.* v, 78 (1819), the name which Fries first used with *S. Ulmi* as type.

Septoria Fr. *Syst. Myc. Elenchus*, II, 117 (1828).

Valid publication of this genus dates from 1828 when Fries (loc. cit.) spelt the name with an *o* and listed three species, *S. Ulmi*, *S. Oxyacanthae* and *S. Fraxini*. *Septaria* Fr. is therefore an orthographic variant of *Septoria* Fr. the valid name.

In 1832 (*Syst. Mycol.* III, ii, 480) Fries described *Septoria* again and observed that the spores may be borne in "perithecia" (pycnidia) or not. He did not list any species this time but noted that Desmazières had added two species, *S. Rosae* Desm. and *S. Heraclei* Desm. The former is a pycnidial form. Fries's previously mentioned species, *S. Ulmi*, *S. Oxyacanthae* and *S. Fraxini*, do not have pycnidia.

Phleospora Wallr. in *Fl. Crypt. Germ.* 176, 1833.

This genus was described with two species, *P. Ulmi* and *P. Oxyacanthae*, and is therefore a synonym of *Septoria* Fr. 1828.

Septoria Sacc. *Syll. Fung.* III, 474 (1884) non Fr.

Saccardo (*Michelia*, II, 6 (1880)) recognized four sections of *Septoria* Fr. Of these one was *Euseptoria* "Perithecia distincta; spermatia angustissima.—Ex. *S. Crataegi* Kx., *S. Cytisi* Desm.", and another was *Phleospora* Wallr.—"Perithecia obsoleta; spermatia crassiora.—Ex. *S. Ulmi* Fr., *S. Oxyacanthae* Kunze".

In 1884 (loc. cit.) he restricted the use of the name "*Septoria* Fr." to his own section, *Euseptoria*, i.e. for species that form definite pycnidia, and raised *Phleospora* Wallr. to generic rank again to take the non-pycnidial species.

Although complete unanimity does not exist even to-day about the use of the name *Septoria*, yet most modern mycologists employ this large and economically significant genus in Saccardo's way: Grove, *J. Bot., Lond.*, LVII, 206–8 (1919) and *Br. Stem and Leaf Fung.* I, 365 (1935); Allescher in Rabenhorst, *Kryptogamen-Fl. Deutschl.* I, vi (1), 704 (1901); Potebnia, *Ann. Mycol.* XIII, 64 (1910); Clements & Shear, *Genera of Fungi*, 368 (1931); Diedicke, *Ann. Mycol.* x, 484 (1912) and *Kryptogamen-Fl. Mark Brandenburg*, IX, vii, 421 (1915); Migula, *Kryptogamen-Fl. Deutschl.* III, iv (1), 374 (1921). With the exception of the last two, who distribute the non-pycnidial species among Melanconiaceous genera, *Cylindrosporium* Unger, *Septogloeum* Sacc., etc., these writers employ *Phleospora* for the forms with incomplete pycnidia.

O. Kuntze (loc. cit.) adopted *Septaria* Fr. (1819) based on *S. Ulmi* Fr. for the non-pycnidial species compiled by Saccardo under *Phleospora* and transferred all the species which Saccardo includes under *Septoria* to *Rhabdospora* Dur. & Mont. He has no following.

The name *Septoria* has thus been used in three different ways:

(1) For non-pycnidial forms as when it was founded by Fries with *S. Ulmi* Fr. as type and again when Kuntze restored it. In this sense *Phleospora* Wallr. is an exact synonym of it.

(2) For both non-pycnidial and pycnidial forms, as expanded by Fries himself in 1832 and followed by other authors.

(3) For pycnidial forms only, as it was emended by Saccardo in 1884. Since, however, this excludes Fries's type species, it cannot now be accepted as an emendation of his genus and if its use is to be continued it must be accepted as a new genus *Septoria* Sacc. and be conserved against its earlier homonym *Septoria* Fr.

Recommendation. As the genus *Septoria* Fr. was based originally on a non-pycnidial species (*S. Ulmi*), was then expanded to take both non-pycnidial and pycnidial species, and was later reduced by Saccardo in 1884 to include only pycnidial species; and as in later years this latter use has overwhelmingly prevailed, it is recommended that Saccardo's use of *Septoria* be attributed to Saccardo himself, and that *Septoria* Sacc. (1884) with type species *S. Cytisi* Desm. be conserved against *Septoria* Fr. (1828).

Phleospora Wallr. (1833), which was based on non-pycnidial species (*P. Ulmi* and *P. Oxyacanthae*) and is an exact synonym of *Septoria* Fr. (1828), will then become available for non-pycnidial species.

If *Septoria* Sacc. is united with *Phleospora* Wallr. (=*Septoria* Fr.), the earliest name for the aggregate genus, i.e. *Septoria* Fr., must be adopted, in accordance with Art. 21, note 3, and Art. 56 of the *International Rules.*

RAMULARIA Sacc. (1880) versus *Ramularia* (Ung.) Corda (1842)

The published proposal is to conserve *Ramularia* Fresen. in *Beitr.* 88 (1863), Sacc. in *Michelia*, II, 20 (1880), non Unger, *Exanth.* 169 (1833)—type *R. lactea* [Desm. in *Ann. Sci. Nat.* (3), XIV, 109 (1850), sub *Fusisporio*] Sacc. in *Michelia*, II, 549 (1881)—against *Cylindrospora* Schroet. in *Pilz. Schles.* II, 485 (1897) ex Grev.

Ramularia (Ung.) Corda *Icon. Fung.* v, 7 (1842).

Unger (in 1833, loc. cit.) described and figured two species of *Ramularia*, *R. pusilla* and *R. didyma*, but gave no generic diagnosis. Under the present Rules, a generic name unaccompanied by a generic diagnosis can only be accepted as validly published if the proposed genus is founded on a single species (Art. 43) and therefore *Ramularia* was not validly published by Unger. The name was, however, validly published when Corda (*Icon. Fung.* v, 7 (1842)) gave a generic diagnosis based on *R. pusilla* (which has non-septate conidia); since when the genus may properly be cited as *Ramularia* (Ung.) Corda. Corda (*Icon. Fung.* v, 9) excluded Unger's second species (which has uni-septate conidia) and made it the type of his own genus *Didymaria*. Later, both Cesati and Fresenius (loc. cit.) described species of *Ramularia* with several septate spores but they did not re-define Corda's genus.

Ramularia Sacc. *Michelia*, II, 20 (1880).

In 1880 Saccardo (loc. cit.) claimed to emend "*Ramularia* Ung.", basing the description on *R. Urticae* Ces. and *R. Cynariae* Sacc. (which have pluriseptate conidia) and at the same time he erected the genus *Ovularia* (*Michelia*, II, 17) for species with non-septate conidia. The next year he transferred *R. pusilla* to *Ovularia* (*Michelia*, II, 170).

Over 400 species of *Ramularia* have been compiled in *Ramularia Sylloge*, and this number has been, and is still being added to. As Saccardo's conception of *Ramularia* has been generally accepted it would be convenient to attribute the "emended genus" to him. *Ramularia* Sacc. can then be conserved against *Ramularia* (Ung.) Corda, of which *Ovularia* Sacc. is a synonym.

The reason for suggesting *R. lactea* as the type is obscure. Cesati appears to have been the first to use *Ramularia* in the sense of Saccardo and it is therefore proposed that, following the suggestion of Clements & Shear, *R. Urticae* Ces., the earliest of the two species on which Saccardo founded his genus, be adopted as the type.

Cylindrosporium Grev. *Scot. Crypt. Flor.* 1, no. 27 (1823).

Greville in 1823 (loc. cit.) founded the genus *Cylindrosporium* on the single species *C. concentricum*, the non-septate spores of which are extruded through the epidermis of the host. A genus founded on this species cannot clash with *Ramularia* of Saccardo. Unger in 1833 (*Exanth.* 166) used Greville's genus under the orthographic variant *Cylindrospora* to cover diverse elements. In 1897 Schroeter (loc. cit.) adopted "*Cylindrospora* Grev." to replace *Ramularia* in the sense of Saccardo. As this excluded Greville's type species, Schroeter's use is now invalid and as the thirty-eight binomials he proposed have not been taken up it is neither necessary nor useful to propose a genus "*Cylindrospora* Schroet." and conserve it against *Cylindrosporium* Grev.

Recommendation. As *Ramularia* of Saccardo's use has been almost universally accepted by mycologists and plant pathologists it is recommended that the genus be attributed to him, and that *Ramularia* Sacc. (1880), type species *R. Urticae* Ces., be conserved against *Ramularia* (Ung.) Corda (1842).

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LIST OF BRITISH USTILAGINALES

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Introduction

The list of British Ustilaginales is the second of the lists of British Fungi to be completed in accordance with the recommendations of the Plant Pathology Committee, already noted in these *Transactions* (xxiv, 1940, p. 126).

Little taxonomic work has been done on the British Ustilaginales during the present century, and Plowright's monograph published in 1889 remains the standard work. This volume contains descriptions of forty-nine species, excluding those no longer recognized as smuts. Massee (1913), in a book based on Plowright's monograph, gave a number of additional hosts which are not all derived from British records.

The seventy names appearing in this list are arranged alphabetically under the three families, Ustilaginaceae, Tilletiaceae and Graphiolaceae. Occasionally, for example, the smuts of Scabious and the members of the genus *Entorrhiza*, where references could not be separated satisfactorily from internal evidence, the fungi are placed collectively under one specific name. A few obvious errors have been corrected by the examination of herbarium material, but the work is based mainly on the records and must be accepted as such. The references which are given to a few standard works indicate where changes in nomenclature have been proposed.

In the Ustilaginales many of the changes in the specific epithet arise from divergent views as to the best method of classifying physiologic forms. In this group, more than in any other, the tendency has been to give such forms specific rank. Up to a point this procedure aided diagnosis, as it often linked only one angiospermic genus with a particular species of smut, but the results of more intensive work, so far conducted on a few species only, suggest that both host and pathogen comprise a complex network of biotypes and that the limits set by the classificatory units of higher plants are not strictly followed by the fungus as, for example, in *Ustilago Kolleri*, where a physiologic form (C 2/2), which is homozygous for pathogenicity, can infect both *Avena sativa* and *A. strigosa*, species of oats which belong to two different chromosome groups. The interrelations of physiologic forms can be determined only by a long series of experiments, and it seems that an essential attribute of any system for cataloguing them is elasticity. This is provided in numerals, combined with trinomials where the

groups are large and well defined, as in the classic example of *Puccinia graminis*.

It has been argued (Huxley, *The New Systematics*, 1940, 4), that species are "distinct self-perpetuating units with an objective existence in nature", and that speciation is more than a convenient catalogue. The comparatively recent discovery of sexuality in the Ustilaginales, with attendant problems of crossing and sterility, makes it no longer impossible to view speciation from such an angle in this group. This is, however, a matter for the future. Data will be needed, not only on the number of physiologic forms and their distribution in nature, but also on their potential and actual ability to cross. Correlations should be examined between physiologic specialization and minute morphological and physiological characteristics. Not only host specialization, but the whole range of variability within and beyond the limits of an accepted species must come under review. In my opinion, weighting each physiologic form with a binomial and an authority only tends to obscure genetic relationships, and does nothing to clarify the species concept.

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USTILAGINACEAE

Cintractia Caricis (Pers.) Magn. Sowerby as *Farinaria carbonaria* **42**, t. 396, f. 4, 1803, on *Carex Micheliana*; **51**, 443, 1824 as *Uredo urceolorum*; **58**, 204; **20**, 375; **19** (2, v, 463, No. 479, 1850) as *Ustilago Montagnei* on *Rhynchospora alba*; **18**, 335; **52**, 203; **15**, 513 as *U. urceolorum*; **65** (xi, 469) on *Scirpus caespitosus* in Forfarshire; **13**, 253; **10**, 276 as *U. Caricis* on *Carex* and *Rhynchospora*; **9**, 174; **71** (xxviii B, 137); **50**, 188; **27** (lx, 168) as *Cintractia sub-inclusa* on *Carex riparia*. On *Carex* and *Rhynchospora*.

Lindau (1914) 33 as *C. Caricis* on *Carex* and *Rhynchospora*; Clinton (1904) 401 and 398. Schellenberg (1911) 74, and Bubák (1916) 29 and 30 use the name *C. Montagnei* (Tul.) Magn. for the smut on *Rhynchospora* and *C. Caricis* (Pers.) Magn. for that on *Carex*; Liro (1938) and others have subdivided the species still further; Ciferri (1938) 254. The smut on *Scirpus* is sometimes regarded as distinct (Schellenberg (1911) 77 and Liro (1938) 43).

— **patagonica** Cooke & Massee in **14** (xviii, 34, 1889), type from Patagonia; **56** (xxvii, p. cxcvii, 1903), on *Bromus unioloides* from seed from Patagonia; **31** (xxxiii, 14, 1903); **28** (iv, 330); **50**, 203. On *Bromus unioloides*.

Clinton (1904) 349 gives this as a synonym of *Ustilago bromivora* (Tul.) Fisch. v. Waldh.

Sorosporium Saponariae Rudolphi. Southwell **14** (x, 67, 1881) as *Ustilago Rudolphi* in ovaries of *Dianthus deltoides* in a garden, Norwich; **10,** 296 as *Sorosporium Saponariae*; **9,** 202; **56** (xxvi, 651 and 654); **56** (xxvii, 31); **50,** 203. On Caryophyllaceae.

Schellenberg (1911) 160; Lindau (1914) 36; Bubák (1916) 33. Liro (1938) 61 as *Sorosporium purpureum* (Hazsl.) Liro; Ciferri (1938) 239 as *S. Saponariae* on *Saponaria officinalis*, some forms on other members of the Caryophyllaceae are given different specific names.

Sphacelotheca Hydropiperis (Schum.) de Bary. Cooke **52** (4th ed., 229, 1878) as *Ustilago Candollei*, in ovaries of *Polygonum Hydropiper* and other species of *Polygonum* **14** (v, 57, 1876 and p. 100); **81,** 262; **10,** 282 as *S. Hydropiperis*; **9,** 181; **50,** 200; **71** (XLII, B, 4, 49); **70** (XXI, N.S. 395). On *Polygonum*.

Clinton (1904) 394; Schellenberg (1911) 65; Lindau (1914) 35; Liro (1924) 2; Bubák (1916) 28; Ciferri (1938) 278.

— **inflorescentiae** Trel. Wilson **28** (IX, 143, 1924). In bulbils of *Polygonum viviparum*, Perthshire, 1914 and 1921. On *Polygonum viviparum*.

Clinton (1904) 383 as *Ustilago Bistortarum* var. *inflorescentiae* Trel.; Schellenberg (1911) 69 as *Sphacelotheca Polygoni-vivipari* Schellenb.; Liro (1924) 7 as *Ustilago ustilaginea* (DC.) Liro; where the generic position of this fungus is discussed, p. 165. Ciferri (1938) 273 as *Sphacelotheca ustilaginea* (DC.) Cif.

Sphacelotheca Reiliana (Kühn) Clinton. Cooke **89,** 236, 1906 as *Ustilago Reiliana* on maize. On *Zea Mays*.

Clinton (1904) 393; Bubák (1916) 27; Ciferri (1938) 267 as *Sphacelotheca Holci-Sorghi* (Rivolto) Ciferri.

Thecaphora seminis-Convolvuli (Desm.) Liro. Berkeley & Broome **19** (3, XVIII, 121, No. 1148, 1866) as *T. hyalina* Fingerhuth, in capsules of *Convolvulus* **19** (4, VII, 731, No. 1310, 1871) recorded near Bath and in some other *Soldanella* at King's Lynn; **52** (4th ed., 231); locality; **14** (II, 186) on fruit of *C. sepium*; **14** (v, 73); **10,** 296; **9,** 200; **50,** 202, on *C. arvensis*. On *Convolvulus*.

Schellenberg (1911) 156 on *C. arvensis*; Lindau (1914) 38 and Bubák (1916) 37 as *Thecaphora capsularum* (Fr.) Desm. on *C. arvensis* and *C. sepium*; Liro (1938) 59 *T. seminis-Convolvuli* (Duby) Liro on *C. arvensis*; Ciferri (1938) 230 *T. hyalina* on *C. sepium* and *C. Soldanella*, 234 *T. Passeriniana* (Cocconi) Cif. on *C. arvensis*.

— **Lathyri** Kühn. Drummond **28** (IX, 144, 1924) in seeds of *Lathyrus pratensis* L. near Edinburgh 1923. On *Lathyrus pratensis*.

Schellenberg (1911) 158 and Bubák (1916) 37 as *T. deformans* Dur. & Mont.; Liro (1938) 58 and Ciferri (1938) 233 as *T. Lathyri*.

— **Traillii** Cooke. Trail **14** (XI, 155, 1883); **40** (VII, N.S. I, 85, 1883) on *Carduus heterophyllus*, Scotland; **40** (VIII, N.S. II, 228); **10,** 296; **9,** 201; **50,** 202. On *Carduus*.

Ustilago Avenae (Pers.) Jens. Kirby **45** (v, 112, 1800) as *Reticularia segetum* in experiments on control; **55** (II, 704, 1817); **92,** 15 as *Uredo segetum*; **120,** 538 as *Ustilago segetum* on the deformed glumes of grasses; **20,** 374; **51,** 442 as *Reticularia segetum*; **58** (II, 203); **15,** 512 as *Ustilago carbo*; **40** (III, 309); **18,** 335 as *U. segetum*; **52,** 202, 1865; **13,** 252; **81,** 254 as *U. carbo*; **65,** 488 as *U. segetum*; **9,** 172; **10,** 273 as *U. segetum*; **71** (XXVIII, B, 137) as *U. Avenae*; **71** (XL, B_2, 49). Control and incidence on oat varieties **23** (II, 323, 1895; XX, 799; XXIV, 1417; XXV, 1486); **25** (II, 426; XXVI, 202; XXXII, 74 and 234); **49** (IV, 110); **79** (I, 28; V, 24; XI, 43); **24** (I, 14; II, 222; III, 42 and 198; VI, 220; XX, 52); **26***a* (Ser. C, No. 1, 28, 1921; Ser. C, No. 3, 46); **34** (XIX, 462); **22** (No. 21, 11, 1918; No. 33, 30; No. 38, 16; No. 52, 14; No. 70, 12; No. 79, 15); biochemistry in **66** (CCXX, B, 99); biology in **34** (XII, 314); **34** (XV, 586; XVI, 65; XX, 258; XXIII, 245. On *Avena*.

Bubák (1916) 15; Lindau (1914) 19; Clinton (1904) 344; Schellenberg (1911) 6; Liro (1924) 98; Ciferri (1938) 285.

Ustilago Bistortarum (DC.) Koern. Cooke **14** (v, 118, 1877) as *Tilletia bullata* on leaves of *Rumex obtusifolius*, Glasgow, collected by Paterson*; **52** (4th ed., 233); **81**, 253; **10**, 277 as *Ustilago Bistortarum* on *Polygonum Bistorta* and *Rumex?* sp., **9**, 175; **50**, 193; **28** (IX, 143) on leaves of *Polygonum viviparum*, Perthshire. On *Polygonum*.

Two leaf smuts of *Polygonum* are sometimes recognized, *U. pustulata* (DC.) Wint. and *U. marginalis* (DC.) Lév.; see Bubák (1916) 17; Liro (1924) 9 and 11; Ciferri (1938) 364 and 367. Clinton (1904) 382 and Lindau (1914) 28 give *U. Bistortarum*; Schellenberg (1911) 35 and 38 refers to two species under the names *U. Bistortarum* and *U. marginalis*.

— **bromivora** (Tul.) Fisch. v. Waldh. **31** (VIII, 19, 1877) on *Bromus mollis* near Kilburn; **52** (4th ed., 230); **10**, 278 on *Bromus secalinus* and *B. mollis*; **9**, 175 on species of *Bromus*; **23** (III, 289); **50**, 190; **22** (No. 52, 42). On *Bromus*.

Clinton (1904) 349; Schellenberg (1911) 18; Lindau (1914) 22; Bubák (1916) 13; Ciferri (1938) 297. Liro (1924) 91 gives specific rank to three physiologic forms of this smut. G. W. Fischer (*Mycologia*, XXIX, 408, 1937) considers that it is indistinguishable morphologically from the ear smuts of some other grasses and unites them under the name *U. bullata* Berk.

— **Cardui** Fisch. v. Waldh. Cooke **52** (4th ed., 231, 1878); **10**, 282 on *Carduus acanthoides*; **9**, 181; **50**, 190 in the ovaries of *C. acanthoides* and *C. nutans*. On *Carduus*.

Schellenberg (1911) 46; Bubák (1916) 24; Lindau (1914) 32; Liro (1924) 55; Ciferri (1938) 392.

— **grandis** Fr. Berkeley & Broome **19** (2, v, 463, No. 480, 1850) as *Ustilago Typhoides* on the stems of *Arundo Phragmites* (*Phragmites communis*), Fens of Cambridgeshire; **18**, 335; **52**, 203; **15**, 513 as *U. grandis*; **81**, 252; **10**, 275; Massee **9**, 173 and **50**, 192 gives as hosts *Typha latifolia* and *T. minor* (probably in error, see Liro 1924, p. 406). On *Phragmites communis*.

Schellenberg (1911) 22; Bubák (1916) 11; Lindau (1914) 20; Liro (1924) 82; Ciferri (1938) 322.

— **Hordei** (Pers.) Lagerh. See under *U. Avenae* for records up to 1889. Plowright **31** (v, 375, 1889) as *U. tecta*; **56** (XIII, 116); **71** (XI., B_2, 49) as *U. Hordei*; control and incidence on barley varieties in **23** (II, 323, 1895; XXIV, 1388 and 1417; XXV, 1486; XXIX, 1050); **25** (XXIV, 161, 1924; XXVI, 200; XXVIII, 184; XXIX, 50; XXX, 94; XXXII, 74); **79** (I, 28; v, 24; XI, 44); **80** (XXIII, 20); **24** (XIX, 55; XX, 53); **22** (No. 21, 11, 1918; No. 33, 31; No. 38, 18; No. 52, 16; No. 70, 13; No. 79, 17); **26*a*** (Ser. C, No. 3, 46, 1923); hyphal fusions, seedling infection, physiology and genetics in **67** (CI, B, 126, 1927; CII, B, 174; CIII, B, 547); longevity of spores in **34** (XV, 595). On *Hordeum*.

Clinton (1904) 341; Schellenberg (1911) 11; Lindau (1914) 23; Bubák (1916) 10; Liro (1924) 103; Ciferri (1938) 312.

— **hypodytes** (Schlecht.) Fr. Berkeley & Broome **19** (1, VI, 439, No. 256, 1841) on Spittal Links, Berwick; **19** (2, v, 463, No. 481, 1850) on *Bromus erectus* at King's Cliffe; **18**, 335 on stems of various grasses; **14** (v, 100); **52**, 203; **15**, 513; **13**, 252; **10**, 273; Massee **9**, 172 and **50**, 193 includes *Phragmites communis* as host, but Liro (1924) suggests that this record should refer to *U. grandis*; **56** (XVI), XXI, 1894 as species of *Ustilago* (*?U. hypodites*) on *Psamma arenaria* on the east coast; **22** (No. 79, 51); **37** (1936, 17). On Gramineae.

Clinton (1904) 338; Schellenberg (1911) 25; Lindau (1914) 23; Bubák (1916) 11; Liro (1924) 88; Ciferri (1938) 305.

* I have not seen this specimen, but the description given does not tally with *U. Parlatorei* Fisch. v. Waldh. a smut which occurs on dock. Another specimen in the Kew Herbarium labelled *Tilletia bullata* on *Rumex obtusifolius* was found to be *U. Bistortarum* (with marginal sori) and the host was certainly not *Rumex* but was probably *Polygonum Bistorta*. It is doubtful if the Glasgow specimen was on *Rumex*.

Ustilago Kolleri Wille. See under *U. Avenae* for records up to 1889. **5** B, 211 and 401, 1915 as *U. Avenae* var. *levis*; **71** (XL, B_2, 49) as *U. Kolleri*; control and incidence on oat varieties in **23** (XXV, 1486); **25** (XXVI, 202; XXXII, 234); **49** (IV, 110); **26a** (Ser. C, No. 1, 28, 1921 and Ser. C, No. 3, 46, 1923); **34** (XIX, 462); **22** (No. 38, 16; No. 52, 14; No. 70, 12; No. 79, 15); hyphal fusions, seedling infection, physiology and genetics in **67** (CI, B, 126, 1927; CII, B, 174; CIII, B, 547; CVIII, B, 395); biology in **34** (XII, 314; XV, 586; XVI, 65; XX, 258; XXIII, 245). On *Avena*.

Clinton (1904) 342 as *U. levis*; Schellenberg (1911) 10; Lindau (1914) 19; Bubák (1916) 9; Liro (1924) 101; Ciferri (1938) 289.

— **Kühneana** Wolff. Berkeley **31** (N.S. VI, 15, 1876); **31** (N.S. VI, 45, 1876); **14** (V, 57) on *Rumex Acetosa*; **19** (5, i, 27, No. 1707, 1878) on *R. Acetosella* at Rothamsted; **52** (4th ed., 231, 1878); **81**, 262; **10**, 281; **9**, 180; **50**, 194. On *Rumex*.

Schellenberg (1911) 42; Bubák (1916) 20; Ciferri (1938) 370. Liro (1924) 25 regards the form on *R. Acetosa* as a distinct species, *U. stygia* Liro.

— **longissima** (Sow. ex Schlecht.) Meyen. *Uredo longissima* in Sowerby **42**, t. 139, 1799; **20**, 375, 1836; **55**, 725; **18**, 335 as *Ustilago longissima* on leaves of *Poa* (*Glyceria*) *aquatica*; **52**, 203 1865; **15**, 512; **40** (II, 309) in Moray; **14** (V, 100); **13**, 252; **81**, 260; **10**, 273 on *G. aquatica* and *G. fluitans*; **71** (XXVIII, B, 137); **70** (XXI, N.S. 395). Massee **9**, 171 and **50**, 192 gives *Phalaris arundinacea* as an additional host, but this may refer to *U. echinata* Schroet. On *Glyceria*.

Clinton (1904) 339; Schellenberg (1911) 23; Lindau (1914) 22; Bubák (1916) 12; Liro (1924) 83; Ciferri (1938) 308.

— **major** Schroet. Plowright **10**, 281, 1889 in the anthers of *Silene Otites* near Brandon; **9**, 179; **50**, 191. On *Silene Otites*.

Clinton (1904) 377 as *U. violacea* var. *major* Clint. on *Silene Watsoni*; Schellenberg (1911) 52 as *U. major* Schroet. on *S. Otites*; Lindau (1914) 30; Bubák (1916) 22; Liro (1924) 41; Ciferri (1938) 384 in his subdivisions of *U. violacea*.

— **marina** Dur. d. Maisonn. Cooke **14** (XIV, 90, 1885) on rhizomes of *Scirpus parvulus* at Little Lea, Poole, Dorset; **31** (XXV, 19); **10**, 275; **50**, 194. On *Scirpus*.

Liro (1938) 227.

— **nuda** (Jens.) Rostr. See under *U. Avenae* for records up to 1889. **31** (V, 375, 1889) as *U. nuda*; **71** (XL, B_2, 49, 1931); incidence and control in **23** (II, 323, 1895; XXIV, 1388 and 1417; XXV, 1486); **25** (XXVI, 201); **22** (No. 21, 11, 1918; No. 33, 31, 1919; No. 38, 19, 1922; No. 52, 17; No. 70, 13; No. 79, 17). On *Hordeum*.

Clinton (1904) 345; Schellenberg (1911) 4; Lindau (1914) 24; Bubák (1916) 15; Liro (1924) 107; Ciferri (1938) 316.

— **olivacea** (DC.) Tul. Berkeley **20** (V, 376, 1836) as *Uredo olivacea*; **18**, 335 as *Ustilago olivacea* on seeds of Carices; **52**, 203, 1865; **15**, 513; **10**, 277 on the fruits of *Carex riparia*; **9**, 175; **50**, 188. On *Carex*.

Clinton (1904) 354; Schellenberg (1911) 32; Lindau (1914) 24; Bubák (1916) 32 as *Elateromyces olivaceus* (Bubák) DC.; Liro (1938) 49 as *Farysia Caricis* (DC.) Liro; Ciferri (1938) 248 as *Farysia olivacea* (DC.) Syd.

— **Ornithogali** (Schm. & Kze.) Magn. Mason **35** (1928, 169) at Tadcaster, Yorkshire, on *Gagea lutea* collected by W. G. Bramley; **115**, 42. On *Gagea*.

Schellenberg (1911) 21; Lindau (1914) 26; Bubák (1916) 12; Liro (1924) 114; Ciferri (1938) 350.

— **perennans** Rostr. See under *U. Avenae* for records up to 1889. Smith & Ramsbottom **28** (VI, 374, 1914) on *Arrhenatherum elatius*; **26a** (Ser. H, No. 1, 67, 1922); **22** (No. 52, 41, 1926; No. 70, 31; No. 79, 50). On *Arrhenatherum elatius*.

Clinton (1904) 343; Schellenberg (1911) 8; Lindau (1914) 20; Bubák (1916) 13; Liro (1924) 95 as *U. decipiens* (Wallr.) Liro; Ciferri (1938) 295 as *U. Holci-Avenacei* (Wallr.) Cif.

Ustilago Scabiosae (Sow.) Wint. *Farinaria Scabiosae* Sowerby in **42**, t. 396, f. 2, 1803 on *Scabiosa arvensis*; **51**, 443, 1824 as *Uredo flosculorum*; **58**, 204; **20**, 379; **18**, 335 as *Ustilago flosculorum*; **52**, 204, 1865; **15**, 515; **14** (IV, 69) as *U. intermedia*; **40** (III, 200); **13**, 253; **40** (v, 234) as *U. Succisae* on *Scabiosa Succisa* at Rannock; **71** (XXVIII, B, 137) as *U. Scabiosae*; **71** (XLII, B, 4, 49) on *Scabiosa Succisa*; Plowright **10**, 279 recognized as distinct *U. Scabiosae* (Sow.) Wint. on *Scabiosa arvensis* and *U. flosculorum* (DC.) Fr. on *S. Columbaria*, *S. arvensis* and *S. Succisa*, giving *U. intermedia* Schroet. and *U. Succisae* Magn. as synonyms of *U. flosculorum*; Massee **9**, 178 and **50**, 191 gives only the one species *U. Scabiosae*. On *Scabiosa*.

An anther smut of *Scabious* has been described under the following names: *Ustilago Scabiosae* (Sow.) Wint. on *Scabiosa* (*Knautia*) *arvensis*; see Schellenberg (1911) 55, Lindau (1914) 31, Bubák (1916) 20, Liro (1924) 51; *U. flosculorum* (DC.) Fr. on *S. arvensis* see Bubák (1916) 21; Liro (1924) 53; *U. intermedia* Schroet. on *S. Columbaria*, see Schellenberg (1911) 57, Bubák (1916) 21; *U. Succisae* Magn. on *S. pratensis*, see Schellenberg (1911) 58, Bubák (1916) 21, Liro (1924) 54.

— **striaeformis** (Westend.) Niessl. *U. Salvei* B. & Br. in **19** (2, v, 463, No. 482, 1850) on leaves of *Dactylis glomerata*, St Margaret's, Guernsey; **18**, 335; **52**, 203, 1865; **15**, 514; **40** (VII, N.S. I, 34, 1883) on leaves of *Holcus* and *Triticum* [*Agropyron*]; **10**, 284 as *Tilletia striaeformis* on *Dactylis glomerata*, *Triticum* [*Agropyron*] *repens*, and *Holcus lanatus*; **9**, 177 and **50**, 192 as *Ustilago Salvei* on leaves of a grass; **37**, 146 as *Tilletia de Baryana* on many grasses; **71** (XXVIII, B, 137) as *Tilletia striaeformis*; **71** (XLII, B, 4, 49) as *Tilletia de Baryana* on *Holcus mollis* and on species of *Agrostis*. On Gramineae.

Clinton (1904) 370; Schellenberg (1911) 33; Lindau (1914) 41; Bubák (1916) 45. The stripe smut on *Triticum* (*Agropyron*) *repens* is sometimes given another name, see *Tilletia Calamagrostidis* Fuck. in Lindau (1914) 43 and *T. aculeata* Ule in Bubák (1916) 45. According to Liro (1924), *U. striaeformis* (Westend.) Niessl is a large collective species. This binomial is retained for the form on *Holcus lanatus*, *Phleum pratense* and some other grasses; *U. Salvei* B. & Br. is used for the stripe smut of *Dactylis glomerata*. Davis (*Phytopathology*, XXV, 810, 1935) finds that American material differs from European and gives the name *U. Clintoniana* Davis to the stripe smut of this grass. Ciferri (1938) 339 uses the name *U. linearis* (Dozy & Molkenboer) Cif. for stripe smut in the widest sense, and gives a number of names to forms of subspecific rank.

— **Tragopogi-pratensis** (Pers.) Rous. Berkeley **18**, 335, 1860, as *U. receptaculorum* on receptacles of goat's beard; **15**, 515; **52**, 204, 1865; **13**, 253 on *Tragopogon* and *Carduus heterophyllus* (perhaps an error, see *U. Cardui*); **10**, 281 as *U. Tragopogi* on *Tragopogon pratensis*; **40** (x, N.S. 4, 369, 1890); **9**, 180 as *U. Tragopogi*; **71** (XXVIII, B, 137); **50**, 190; **22** (No. 70, 40) on Salsify. On *Tragopogon*.

Schellenberg (1911) 46; Lindau (1914) 31; Bubák (1916) 23; Liro (1924) 56; Ciferri (1938) 396.

— **Tritici** (Pers.) Rostr. See *U. Avenae* for records up to 1889. **5** B, 213 and 401, 1899 as *U. Tritici*; **71** (XL, B_2, 49); incidence and control in **23** (II, 321, 1895; XXIII, 638); **25** (XXVI, 204); **79** (III, 23; v, 24; XI, 43); **85** (XLI, 15); **22** (No. 21, 11, 1918; No. 33, 29; No. 38, 12; No. 52, 12; No. 70, 12; No. 79, 12); longevity of spores **34** (xv, 595, 1928). On *Triticum*.

Clinton (1904) 346; Schellenberg (1911) 2; Lindau (1914) 23; Bubák (1916) 16; Liro (1924) 110; Ciferri (1938) 330.

— **utriculosa** (Nees) Tul. Gray, **120**, 538, 1821 on water-pepper (*Polygonum Hydropiper*?); Berkeley 20, 377, 1836 as *Uredo utriculosa*; **18**, 335 as *Ustilago utriculosa* on seeds of *Polygonum*; **52**, 204, 1865; **15**, 514; **13**, 233; **10**, 280; **9**, 178; **50**, 191. On *Polygonum*.

Clinton (1904) 379; Schellenberg (1911) 59; Lindau (1914) 27; Bubák (1916) 18. Liro (1924) 12–20 and 188, and Ciferri (1938) 358–62 subdivide this species on biometrical and physiological grounds.

Ustilago Vaillantii Tul. Massee **14** (xxi, 120, 1893) on the flowers of *Scilla bifolia* at Newry and on *Chionodoxa* at Kew; **31** (xv, 463, 1894); **37** (Add. Ser. v, 165, 1906) on *Chionodoxa Luciliae*; **71** (xxviii, B, 137); **23** (xx, 799); **74** (ix, 5–14) life-history; **57** (viii, 227) on *C. Luciliae* in Scotland; **65** (xxx, 347) on *Scilla*; **22** (No. 52, 88; No. 117, 56 and 60). On *Chionodoxa*, *Muscari* and *Scilla*.

Clinton (1904) 375; Schellenberg (1911) 19; Lindau (1914) 26; Bubák (1916) 14; Liro (1924) 115; Ciferri (1938) 348 on species of *Muscari*, *U. Scillae* Cif. on *Scilla bifolia*.

— **vinosa** (Berk.) Tul. Berkeley in litt. to Tulasne 1847 as *Uredo vinosa*; **19** (2, v, 464, No. 484, 1850), as *Ustilago vinosa* on the swollen receptacles of *Oxyria reniformis* (*digyna*), Forfarshire; **18**, 335; **52**, 204, 1865; **15**, 514; **13**, 253; **10**, 278; **40** (x, N.S. 4, 368); **9**, 176; **50**, 19. On *Oxyria digyna*.

Clinton (1904) 376; Schellenberg (1911) 41; Liro (1924) 28; Ciferri (1938) 356.

— **violacea** (Pers.) Rous. *Farinaria Stellariae* Sow. in **42**, t. 396, f. 1, 1803, on *Stellaria graminea* and *S. Holostea*; **120**, 538, 1821 as *Ustilago violacea* on anthers of Caryophyllaceae; **51**, 443 as *Uredo antherarum*; **20**, 381; **18**, 335 as *Ustilago antherarum* on *Silene*; **52**, 204, 1865; **31** (xxx, 703 and 763); **15**, 515; **13**, 253; **81**, 260; **31** (v, N.S., 662); **10**, 280 as *U. violacea* on the anthers of *Silene*, *Cerastium*, *Stellaria* and species of *Lychnis*; Plowright **56** (xi, p. cxxix, 1889 and xiii, 114–17) on the influence on the development of floral organs in species of *Lychnis*; **56** (xxvi, 651 and 654 and xxvii, 32) on members of the Caryophyllaceae; **50**, 190; **71** (xlii, B_4, 49) on *Silene acaulis*; **70** (xxi, N.S., 395) on *Stellaria uliginosa*, *Lychnis alba* and *L. dioica*; **31** (c, 254) severe attack on carnations. On Caryophyllaceae.

Clinton (1904) 377; Schellenberg (1911) 49; Lindau (1914) 29; Bubák (1916) 22. Liro (1924) separates *U. violacea* into ten or more species chiefly on grounds of physiologic specialization. Ciferri (1938) 376 *U. violacea* (Pers.) Rous. (*sens. lat.*) is divided into a number of subunits.

— **Zeae** (Beckm.) Unger. Berkeley **31** (1850, 675) as *U. Maydis* on maize from Little Canford; **18**, 335; **52**, 203, 1865; **15**, 513; **10**, 278; **9**, 176; **50**, 189; **85** (xxxv, 20) as *U. Zeae* on a fodder crop of maize. On *Zea Mays*.

Clinton (1904) 362; Schellenberg (1911) 28; Lindau (1914) 17; Bubák (1916) 16 as *U. Zeae-Mays* (DC.) Wint.; Ciferri (1938) 335 as *U. mays-zeae* (DC.) Magn.

TILLETIACEAE

Doassansia Alismatis (Nees) Cornu. Trail **40** (vii, N.S. 1, 124, 1884) on *Alisma Plantago* (*-aquatica*) Aberdeen; **14** (xii, 99, 1884); **10**, 294; **9**, 196; Setchell in a review of the genus **33** (vi, 3); **50**, 200; Grove **1** (ii, 295) states that the fungus referred to as *Cylindrosporium Alismacearum* Sacc. is a *Doassansia* with germinating spores, the sporidia of which were mistaken for a Hyphomycete. *Sphaeria Alismatis* Currey (*Phyllosticta Curreyi* Sacc.) **45** (xxii, 334, 1859) was given by Setchell **33** (vi, 8) as a synonym of *Doassansia Alismatis*, but it is uncertain, see Grove **1** (i, 53). On *Alisma Plantago-aquatica*.

Clinton (1904) 479; Schellenberg (1911) 124; Lindau (1914) 61; Bubák (1916) 70; Liro (1938) 207; Ciferri (1938) 66.

— **Limosellae** (Kze.) Schroet. Grove **27** (lx, 169, 1922) on leaves of *Limosella aquatica* on the exposed mud of Earlswood Reservoir, October 1921, germination of spores and conjugation of sporidia observed; Setchell **33** (vi, 36, 1892) in a review of the genus. On *Limosello aquatica*.

Liro (1938) 222 as *Burrillia Limosellae* (Kze.) Liro.

— **Martianoffiana** (Thüm.) Schroet. Boyd **28** (iv, 185, 1912) on leaves of a species of *Potamogeton* at Ardrossan, Ayrshire, August 1911. On *Potamogeton*.

Clinton (1904) 482. Setchell **33** (vi, 28, 1892) placed this in the subgenus *Doassansiopsis* which has been since raised to generic rank, see Bubák (1916) 71, Liro (1938) 217, and Ciferri (1938) 71, as *Doassansiopsis Martianoffiana* (Thüm.) Diet.

Doassansia Sagittariae (Westend.) C. Fisch. *Aecidium incarceratum** Berkeley & Broome in **19** (4, xv, 36, No. 1469, 1875) at Bungay on leaves of *Sagittaria*; **10**, 267; **14** (III, 124, 1875) as *Protomyces Sagittariae* on *Sagittaria sagittifolia*; **52** (4th ed., 227, 1878); **10**, 295 as *Doassansia Sagittariae*; **9**, 197; **50**, 200; **28** (XIX, 283) at Wicken Fen. On *Sagittaria*.

Clinton (1904) 478; Schellenberg (1911) 123; Lindau (1914) 61; Bubák (1916) 70; Liro (1938) 209; Ciferri (1938) 69.

Entorrhiza Aschersoniana (Magn.) Lagerh. Trail **40** (VII, N.S., 241, 1884) as *E. cypericola* in tubercules on the roots of *Juncus bufonius* near Aberdeen; **14** (XIII, 47, 1884); *Trans. Nat. Hist. Soc. Glasgow*, N.S., I, XXXI, 299, 1886 on *J. squarrosus* and *J. uliginosus*, Clober Moor and near Thornmill; **10**, 299; **40** (x, N.S., 4, 372) as *E. Aschersoniana* on species of *Juncus*; **9**, 195; Trail, *Ann. Scottish Nat. Hist.*, No. 47, 188, 1903, as *E. digitata* on *J. lamprocarpus*; **33** (XXIV, 520) as *E. cypericola* on *J. bufonis*, *J. articulatus* and *J. lamprocarpus*, structure and experiments on the germination of the spores; **50**, 199 as *E. Aschersoniana*. On *Juncus*.

Several species of *Entorrhiza* have been described (Ferdinandsen and Winge, *Dansk. Bot. Ark.* II, No. 1 (1914)). Trail **40** (x, N.S., 4, 372, 1890) suggested that more than one species occurred in Scotland, but British specimens have never been clearly distinguished on spore characters, merely on tubercle and host. See Schellenberg (1911) 102 and Bubák (1916) 58 under the genus *Schinzia*; Lindau (1914) 64, Liro (1938) 67 and Ciferri (1938) 75 under the genus *Entorrhiza*.

Entyloma Calendulae (Oudemans) de Bary. Trail **40** (VII, N.S., I, 124, 1884) on *Hieracium vulgatum* near Aberdeen; **14** (XII, 99, 1884); **10**, 292; **9**, 193; **50**, 198; **71** (XLII B_4, 49); **79** (x, 39; XI, 54; XIII, 29) on a species of *Calendula* in Cornwall; **22** (No. 79, 100). On Compositae.

Schellenberg (1911) 113; Lindau (1914) 50; Bubák (1916) 52; Liro (1938) 135; Ciferri (1938) 176. Forms on different genera of the Compositae are given specific names.

— **Chrysosplenii** (B. & Br.) Schroet. *Protomyces Chrysosplenii* B. & Br. in **19** (4, XV, 36, No. 1472, 1875) on leaves of *Chrysosplenium oppositifolium* at New Pitsligo; **14** (III, 181, 1875); **40** (IV, 348); **52**, 227, 1878; **13**, 251; **10**, 291 as *Entyloma Chrysosplenii*; **9**, 193; **50**, 198. On *Chrysosplenium*.

Schellenberg (1911) 117; Lindau (1914) 47; Bubák (1916) 51; Liro (1938) 116.

— **Dahliae** Syd. Pethybridge **31** (LXXXIV, 393, 1928) on cultivated Dahlias; **56** (LIV, 332) control; **71** (XLII, B, 49); **79** (XI, 55); **85** (XXXIX, 19); **22** (No. 79, 99). On *Dahlia*.

Liro (1938) 131.

— **Fergussoni** (B. & Br.) Plowr. *Protomyces Fergussoni* Berkeley & Broome in **19** (4, XV, 36, No. 1473, 1875) on leaves of *Myosotis* at New Pitsligo; **13**, 251; **14** (III, 181, 1875); **52** (4th ed., 227); **40** (VII, N.S., I, 128, 1884) as *Entyloma canescens* on *M. arvensis* near Aberdeen; **14** (XII, 99); **10**, 289 as *E. Fergussoni* on species of *Myosotis*; **9**, 190; **50**, 197. On *Myosotis*.

Schellenberg (1911) 113; Lindau (1914) 48; Bubák (1916) 54; Liro (1938) 124; Ciferri (1938) 193.

— **fuscum** Schroet. Phillips & Plowright **14** (XIII, 52, 1884) as *E. bicolor* on leaves of *Papaver Rhoeas* at North Wootton; **10**, 290; **9**, 191; **50**, 197. On *Papaver*.

Clinton (1904) 471; Schellenberg (1911) 111; Lindau (1914) 46; Bubák (196) 51; Liro (1938) 114; Ciferri (1938) 186.

* This binomial has been given as a synonym of *Doassansia Alismatis* (Nees) Cornu, for the reason that some of the Rabenhorst No. 1492 exsiccata were leaves of *Alisma Plantago* (see Setchell **33** (VI, 12, 1892) and Liro (1938) 207). Berkeley and Broome state, however, that *Aecidium incarceratum* occurred on *Sagittaria* and the specimen bearing this name in the Kew Herbarium is a *Sagittaria*.

Entyloma Helosciadii Magn. O'Connor **70** (XXI, N.S., 395, 1936) on *Sium erectum* near Dublin, 1932. This record may refer to *E. flavum* Cif. On *Sium erectum*.

Lindau (1914) 48 on Umbelliferae; Bubák (1916) 52 as *E. Helosciadii* Magn. on *Berula angustifolia* and *Sium latifolium*; Liro (1938) 119 as *E. flavum* Cif. on *Sium erectum* and *E. Helosciadii* Magn. on *Helosciadium nodiflorum*; Ciferri (1938) 205.

— **Matricariae** Rostr. Described as a new species by Trail in Plowright; see **40** (X, N.S., 4, 277, 1890) on *Matricaria inodora* near Aberdeen; **10**, 291, 1889; **9**, 192, 1891 as *E. Trailii* Massee; **50**, 197. On *Matricaria*.

Schellenberg (1911) 116; Lindau (1914) 49; Bubák (1916) 53; Liro (1938) 13.

— **microsporum** (Unger) Schroet. Trail **40** (VII, N.S., 228, 1884) as *E. Ungerianum* on leaves of *Ranunculus repens*, and less often *R. acris*; **10**, 291 as *E. microsporum*; **9**, 193; **50**, 198; on species of *Ranunculus*; **71** (XLII, B4, 49); **1** (II, 296) as *Cylindrosporium Ranunculi* Sacc. among species excluded from the Hyphomycetes. On *Ranunculus*.

Clinton (1904) 471; Schellenberg (1911) 121; Lindau (1914) 46; Bubák (1916) 56; Liro (1938) 107; Ciferri (1938) 196.

— **Ranunculi** (Bon.) Schroet. Berkeley & Broome **19** (4, XV, 36, No. 1471, 1875) as *Protomyces microsporus* on the leaves of *Ranunculus Ficaria* at New Pitsligo associated with conidia; **14** (III, 181, 1875); **40** (IV, 348); **14** (VI, 73) as *Entyloma Ungerianum*; **13**, 255; **40** (VII, N.S., 228) as *E. Ficariae*; **10**, 290 as *E. Ranunculi*; **9**, 191; **50**, 197; **71** (XXVIII, B, 137); **71** (XLII, B4, 49); structure and life history **66** (CLXXVIII, B, 173–185).

Conidial stage as *Cylindrosporium Ficariae* in Brit. Fung. Fasc. 3, n. 212; **19** (1, I, 263, No. 135, 1838); **13**, 227; **15**, 475 as *Gloeosporium Ficariae*; **1** (II, 295) as *Cylindrosporium Ficariae* among species excluded from the Hyphomycetes. On *Ranunculus*.

Clinton (1904) 460; Schellenberg (1911) 117; Lindau (1914) 45; Bubák (1916) 50; Liro (1938) 109; Ciferri (1938) 197.

Melanotaenium endogenum (Unger) de Bary. Trail **40** (VII, N.S., 243, 1884) on stems of *Galium verum* near Aberdeen; **14** (XIII, 47, 1884) on *G. Mollugo*; **10**, 293; **9**, 194; **50**, 199. On *Galium*.

Schellenberg (1911) 105; Lindau (1914) 52; Bubák (1916) 48; Liro (1938) 71; Ciferri (1938) 163.

— **cingens** (Beck) Magn. **28** (II, 6, 1903) as *Cintractia cingens* on stems and leaves of *Linaria vulgaris* at Glyndyfrdwy, Denbighshire; **28** (VI, 331, 1920) as *Melanotaenium cingens* in a review of the genus. On *Linaria vulgaris*.

Schellenberg (1911) 107; Bubák (1916) 48; Liro (1938) 72; Ciferri (1938) 164.

— **hypogaeum** (Tul.) Schellenb. Phillips and Plowright **14** (XIII, 52, 1884) as *Ustilago hypogaea* in the root-stock of *Linaria spuria* at Freshwater, Isle of Wight; **10**, 276; **9**, 174; **50**, 194; **28** (VI, 334). On *Linaria spuria*.

Schellenberg (1911) 108; Bubák (1916) 47.

— **Lamii** Beer in **28** (VI, 331, 1920) on the underground parts of *Lamium album* at Chalfont near Stroud, Gloucestershire. On *Lamium album*.

Liro (1938) 73.

Schroeteria Delastrina (Tul.) Wint. Plowright **31** (VI, 506, 1889) in the fruits of *Veronica arvensis* near Fakenham, Norfolk; **28** (I, 99). On *Veronica*.

Conflicting accounts have been given of the germination of spores in this species. Schellenberg (1911) 162 and Lindau (1914) 66 doubt if the fungus should be classified in the Ustilaginales. Bubák (1916) 59, Liro (1938) 224 and Ciferri (1938) 80 include the genus in the Ustilaginales, recognizing two species, *S. Delastrina* (Tul.) Wint. and *S. Decaisneana* (Boud.) de Toni on different species of *Veronica*.

Tilletia caries (DC.) Tul. **45** (V, 112, 1800). Kirby records experiments with bunt of wheat. Hooker **92** (II, 16, 1821) as *Uredo caries*; **51**, 443; **58** (II, 204); **10**, 373; **56** (II, 109, 1847) germination of spores; *Fusisporium inosculans* Berk.

56 (II, 114, 1847) as a parasite on bunt = the secondary spores of *Tilletia caries*; **18**, 335 as *Tilletia caries*; **52**, 202; **15**, 511; **13**, 255; **81**, 245; **10**, 283 as *T. Tritici*; **9**, 183; **50**, 195 on species of *Triticum*; **25** (XXVI, 202) as *T. caries*; **71** (XXVIII, 137) as *T. Tritici*; incidence and control **31** (1844, 492; 1850, 651); **23** (XXIII, 634; XXVII, 1013; XXXVI, 139); **26** (I, 169; II, 188; III, 180); **79** (IV, 15; V, 36); **78** (1928, 138); **85** (XXIII, 19; XXIV, 150); **34** (XV, 245; XIX, 35); **24** (XVII, 117; XVIII, 59; XIX, 55; XX, 52); **22** (No. 21, 11; No. 23, 17; No. 33, 29; No. 38, 11; No. 52, 12; No. 70, 11; No. 79, 11); **22** (No. 21, 11, 1918) as *Ustilago Secalis* on rye (this record refers to bunted heads of rye collected in Shropshire by Dr A. Roebuck; no specimens are available, *teste litt.* January 1940). The bunt on rye (*Secale*) is sometimes given specific rank as *Tilletia Secalis* (Corda) Kühn, see Liro (1938) 89; **22** (No. 79, 20, 1934) as *T. caries* on rye in experimental plots; effect on host **34** (XIV, 83); effect on incidence of *Puccinia glumarum* **34** (XIV, 105); cytology **33** (XXXV, 399); toxicity **28** (X, 121 and XI, 82). On *Triticum*.

Clinton (1904) 432, Schellenberg (1911) 90, Bubák (1916) 39, and Ciferri (1938) 86 as *T. Tritici* (Bjerk.) Wint.; Lindau (1914) 43 and Liro (1938) 86 as *T. caries* (DC.) Tul.

Tilletia decipiens (Pers.) Koern. Cooke as *T. sphaerococca* **14** (XII, 99, 1883) in ovaries of *Agrostis pumila* (= *A. tenuis* Sibth. dwarfed by the fungus, see **27** (LXXIII, 70, 1935) and **36** (I.I, 89)); **10**, 284 as *T. decipiens*; **9**, 184 as *T. separata*; **37** (1899, 150) in a review of the genus; **50**, 195; **36** (I.I, 84, 89 and 94) as *T. decipiens* on *Agrostis canina*, *A. tenuis* and *A. stolonifera*. On *Agrostis*.

Schellenberg (1911) 94; Lindau (1914) 42; Bubák (1916) 43; Liro (1938) 80; Ciferri (1938) 96.

— **Holci** (Westend.) Schroet. Plowright **31** (X, 374, 1891) as *T. Rauwenhoffii* in ovaries of *Holcus mollis* near Doncaster; **28** (I, 60); **71** (XXVIII, 137). On *Holcus*.

Bubák (1916) 40; Liro (1938) 79.

— **Menieri** Har. & Pat. Grove **28** (III, 374, 1911) in the ovaries of *Phalaris arundinacea* at Lock Portmore, Antrim. On *Phalaris arundinacea*.

Liro (1938) 82.

Tuburcinia primulicola (Magn.) Bref. C. Wolley Dod **31** (XXII, 248, 1884) as *Urocystis primulicola* in the capsules of *Primula farinosa* in the garden of Edge Hall, Malpas, Salop; **31** (XXII, 268 and 308, 1884); **19** (5, XV, 345, No. 2049, 1885) on *P. farinosa* in Teesdale and Cumberland; **56** (XII, p. liii) as smut on *P. farinosa* in Lancashire; **40** (X, N.S., 4, 370) in the ovaries of *P. vulgaris*, Aberdeen; **10**, 289; **31** (VII, N.S., 558, 1890); **9**, 189; **56** (XIX, p. xxviii) as *Ustilago primulina*, recovery of previously infected plants; **56** (XXVII, 377) as *Urocystis primulicola*; **50**, 205; life history and cytology of *Tuburcinia primulicola* in *Rep. Brit. Ass. Sec. K, Manchester*, 730, 1915; **28** (V, 290). On *Primula*.

Schellenberg (1911) 155 and Bubák (1916) 61; Lindau (1914) 60 as *Urocystis primulicola* Magn.; Liro (1938) 204 as *Tuburcinia primulicola* (Magn.) Bref. on *Primula farinosa*, *T. Primulae* (Rostr.) Liro on *P. elatior*; Ciferri (1938) 152, as *Ginanniella primulicola* (Magn.) Cif. on *P. farinosa*, *G. Primulae* (Rostr.) Cif. on *P. elatior*.

— **Trientalis** B. & Br. in **19** (2, V, 464, No. 488, 1850) on leaves of *Trientalis europaea* at Aberdeen; **18**, 336; **52**, 212; **15**, 516; **14** (VI, 73) as *Sorosporium Trientalis*; **13**, 254; **40** (VII, N.S., 271, 1884); **10**, 293 as *T. Trientalis*; **9**, 199; **50**, 201; conidial stage **18**, 376, 1860 as *Ascomyces Trientalis*; **15**, 737; **10**, 293 as *Tuburcinia Trientalis*. On *Trientalis europaea*.

Clinton (1904) 446; Schellenberg (1911) 152; Lindau (1914) 54; Bubák (1916) 60; Liro (1938) 201; Ciferri (1938) 154 as *Ginanniella Trientalis* (B. & Br.) Cif.

Urocystis Agropyri (Preuss) Schroet. Cooke **52** (4th ed., 232, 1878) as *U. parallela* on culms and sheaths of rye and on the leaves of Carices (in part); **10**, 286 as *U. Agropyri* on *Triticum* (*Agropyron*) *repens* and *Avena* (*Arrhenatherum*)

elatior; **40** (x, N.S., 4, 277) on *Festuca arenaria*; **9,** 186 in part; **50,** 204 in part. On *Agropyron* and other grasses.

Clinton (1904) 453; Schellenberg (1911) 133; Lindau (1914) 55; Bubák (1916) 62. Liro (1938) 151 as *Tuburcinia Agropyri* (Preuss) Liro on *Triticum repens*, p. 149 as *T. Festucae-elatioris* Hintikka on *Festuca elatior*; Ciferri (1938) 143 as *T. Agropyri* (Preuss) Liro.

Urocystis Anemones (Pers.) Wint. Berkeley exs. No. 236 as *Uredo pompholygodes* on *Anemone nemorosa*; **52,** 212, 1865 as *Polycystis pompholygodes* on *Ranunculus repens* and other members of the Ranunculaceae; **15,** 517 as *Urocystis pompholygodes*; **40** (II, 309) on leaves of *Anemone*, Moray; **14** (v, 100); **13,** 254; **10,** 288 as *U. Anemones* on *R. repens*, *R. bulbosus*, and *A. nemorosa*; **9,** 188; **56** (XXVII, 11 and 14); **56** (XXVII, 937) as *Uromyces* (presumably in error for *Urocystis*) *Anemones*; **71** (XXVIII, B, 137) as *Urocystis Anemones*; **50,** 205; **65** (XXX, 345); **70** (XXI, N.S., 395); **28** (XII, 115) on *Ranunculus Ficaria* and *Trollius europaeus* in Scotland; **22** (No. 79, 93) on *Anemone Pulsatilla*. On Ranunculaceae.

Clinton (1904) 448; Schellenberg (1911) 143; Lindau (1914) 58; Bubák (1916) 66. Liro (1938) 178 and Ciferri (1938) 136 as *Tuburcinia Anemones* (Pers.) Liro on *Anemone nemorosa*. The forms on other genera of the Ranunculaceae are given specific rank.

— **Cepulae** Frost. Cotton **23** (XXVI, 169, 1919) on cultivated onions at Northampton 1917 and 1918; **23** (XXVIII, 443) control; **28** (VII, 65) life history; **24** (IX, 65) control; **96** (II, 106); **23** (XXXIV, 937) on leeks; **65** (XXX, 332 and 338); **23** (XL, 839); **78** (1937, 108) distribution in Britain; **22** (No. 23, 19; No. 33, 45; No. 38, 53 and 55; No. 52, 55 and 56; No. 70, 39; No. 79, 61). On *Allium*.

Clinton (1904) 451; Schellenberg (1911) 140; Bubák (1916) 65; Liro (1938) 167 and Ciferri (1938) 131 as *Tuburcinia Cepulae* (Frost) Liro.

— **Colchici** (Schlecht.) Rab. Berkeley & Broome in **19** (2, v, 464, No. 485, 1850) as *Polycystis Colchici* on leaves of *Colchicum autumnale* at Rudloe, Wiltshire; **18,** 335; **52,** 211; **15,** 517 as *Urocystis Colchici*; **31** (VI, N.S., 421); **81,** 54; **10,** 286; **9,** 186; **56** (XXVII, 399); **50,** 204; **22** (No. 79, 109) on imported bulbs of a species of *Colchicum* and *Bulbocodium vernum*; **22** (No. 117, 56 and 57). On *Colchicum* and *Bulbocodium*.

Clinton (1904) 452; Schellenberg (1911) 137; Lindau (1914) 57; Bubák (1916) 64. Liro (1938) 169 and Ciferri (1938) 141 as *Tuburcinia Colchici* (Schlecht.) Liro.

— **Filipendulae** (Tul.) Schroet. Plowright **28** (I, 60, 1899) as *U. Filipendulae* on *Spiraea Filipendula* on Darnford Down, Salisbury, 1897. On *Spiraea Filipendula*.

Schellenberg (1911) 49; Lindau (1914) 59; Bubák (1916) 69; Liro (1938) 196 as *Tuburcinia Filipendulae* (Tul.) Liro.

— **Fischeri** Koern. Berkeley & Broome **19** (2, v, 464, No. 406, 1850) as *Polycystis parallela* on leaves of *Carex*, Forfarshire; **52,** 212; **15,** 517 as *Urocystis occulta*; **13,** 254 as *Urocystis parallela*; **14** (XIII, 52) as *U. Fischeri* on leaves of *Carex glauca*; **10,** 286; **9,** 186 as *U. Agropyri*; **50,** 204. On *Carex*.

Schellenberg (1911) 135; Bubák (1916); Liro (1938) 159 as *Tuburcinia Fischeri* (Koern.) Liro.

— **Gladioli** (Requien) W.G.Sm. Smith **31** (VI, N.S., 115 and 420, 1876) in corms of *Gladiolus*; **14** (v, 57, 1876); **52** (4th ed., 232); **10,** 287; **9,** 187; **56** (XXVII, 399); **37** (Add. Ser. v, 165, 1906); **50,** 205; **22** (No. 52, 88); **79** (XIII, 34); **22** (No. 117, 121). On *Gladiolus*.

Liro (1938) 173 and Ciferri (1938) 105 as *Tuburcinia Gladioli* (Requien) Liro.

— **occulta** (Wallr.) Rabenh. Berkeley **20,** 375, 1836 as *Uredo parallela* on culms and sheaths of rye, Kensington; **19** (2, v, 464, No. 486, 1850) as *Polycystis parallela*; **18,** 335; **52,** 212; **15,** 517 as *Urocystis occulta*; **81,** 252; **10,** 285; **9,** 185; **50,** 204; **23** (XXV, 1493) control; **22** (No. 38, 22; No. 79, 20). On *Secale*.

Clinton (1904) 452; Schellenberg (1911) 131; Lindau (1914) 55; Bubák (1916) 62. Liro (1938) 155 and Ciferri (1938) 127 as *Tuburcinia occulta* (Wallr.) Liro.

Urocystis sorosporioides Koern. Cooke **14** (VI, 73, 1877) on leaves of *Thalictrum minus*; **52** (4th ed., 232, 1878) on *T. minus* and its var. *maritima*; **40** (IX, N.S., 3, 41); **10,** 287; **9,** 187; **50,** 204. On *Thalictrum.*

Clinton (1904) 450; Schellenberg (1911) 147; Lindau (1914) 58; Bubák (1916) 68; Liro (1938) 191 and Ciferri (1938) 117 as *Tuburcinia sorosporioides* (Koern.) Liro.

— **Violae** (Sow.) Fisch. v. Waldh. *Granularia Violae* Sow. in **42,** t. 440, 1815; **19** (2, V, 464, No. 487, 1850) as *Polycystis Violae* on leaves and especially petioles of violets, Druid's Stoke, Glos. and Isle of Portland, **18,** 335; **31** (XXIV, 464, 1864); **52,** 212; **15,** 517 as *Urocystis Violae*; **31** (VIII, 726); **81,** 54; **13,** 254; **10,** 288 on *Viola odorata* and *V. sylvatica*; **9,** 189; **56** (XXVII, 23); **71** (XXVIII, B, 137); **79** (IX, 43 and XI, 59); **85** (XXXVII, 20 and XXXIX, 19); **22** (No. 70, 60; No. 79, 95). On *Viola.*

Clinton (1904) 450; Schellenberg (1911) 149; Lindau (1914) 59; Bubák (1916) 63. Liro (1938) 197 and Ciferri (1938) 108 as *Tuburcinia Violae* (Sow.) Liro.

GRAPHIOLACEAE

Graphiola Phoenicis (Moug.) Poit. Berkeley & Broome **19** (3, XV, 402, No. 1049, 1865) on leaves of the date palm (*Phoenix dactylifera*), Sheffield Botanic Garden; **15,** 546; **14** (V, 15); **40** (X, N.S. 4, 372) Botanic Gardens, Glasgow; **10,** 298; **9,** 205. On *Palmae.*

Schellenberg (1911) 162 under excluded genera and species; Lindau (1914) 67 under doubtful genera; Bubák (1916) 72; Ciferri (1938) 214.

DOUBTFUL AND EXCLUDED SPECIES

Doassansia Comari (Berk. & White) de Toni & Massee. *Protomyces Comari* Berk. & White in **19** (5, I, 27, No. 1708, 1878) on *Comarum palustre*, Loch of Kinordy, Forfarshire; **14** (VI, 126, 1878); **40** (IV, 255); **13,** 252; as *Doassansia Comari* (Berk. & White) de Toni & Massee in *Journ. Myc.* IV, 18, 1888; **9,** 198; **50,** 201. Transferred to the genus *Physoderma* as *P. Comari* (Berk. & White) Lagerh., see *Bih. k. Svensk. Vet. Akad. Handl.* XXIV, Afd. III, No. 4, p. 11, 1898; **28** (V, 319).

Melanotaenium Ari (Cooke) Lagerh. *Protomyces Ari* Cooke in **14** (I, 7, 1872) on leaves of *Arum maculatum* at Chichester; **52** (4th ed., 227); **10,** 301; R. Beer, **28** (VI, 335) re-examined Cooke's type material and other collections and found the spores to be quite different in character from those of either *Protomyces* or any member of the Ustilaginaceae. It has been accepted as a smut under the name given above by Schellenberg (1911) 109; Bubák (1916) 47 and Ciferri (1938) 161.

Sorosporium scabies Fisch. v. Waldh. **9,** 202, 1891 = *Spongospora subterranea* (Wallr.) Lagerh.

Tilletia Berkeleyi Massee in **37,** 154, 1899 on *Triticum vulgare* from material collected by Berkeley at King's Cliffe, Northants.

Tuburcinia scabies Berk. **52,** 212, 1865; **15,** 516; **10,** 294 = *Spongospora subterranea* (Wallr.) Lagerh.

Ustilago Cucumis A. B. Griffiths. **53** (XV, 404, 1837–88) = name given to zooglea threads in nodules on the roots of *Cucumis sativa*; **31** (XVI, 98, 1894).

Ustilago Ficuum Reichardt **31** (I, 84, 1887) = *Aspergillus Ficuum* (Reichardt) Wehmer = *Sterigmatocystis Ficuum* (Reichardt) P. Henn.

— **grammica** B. & Br. in **19** (2, V, 464, No. 483, 1850) on stems of *Aira aquatica* (probably in error for *Glyceria*) Oxton, Notts; **18,** 335; **52,** 203; **15,** 514; **13,** 252; **10,** 275; **9,** 173. G. R. Bisby and E. W. Mason examined a specimen in the Kew Herbarium from Oxton, Notts (January 1841) and found that the fungus was not a smut but possibly a *Pirostoma.* The host is not an *Aira* but may be *Glyceria aquatica.*

USTILAGINALES RECORDED IN FORAY LISTS

No smut is recorded from the forays of 1897–1904 inclusive. The species listed from subsequent forays are given below, with the dates of the forays, except that for three common species the date of the first foray record is followed by the number of subsequent records. Autumn and spring forays are not distinguished. The names of host plants are omitted, as few of these are noted in the foray reports.

USTILAGINACEAE

Cintractia Caricis, 1927, 1938.
Sphacelotheca Hydropiperis, 1905 and eighteen subsequent forays.
Ustilago Avenae, 1918, 1927, 1931, 1938; *Hordei*, 1924; *hypodytes*, 1910, 1912, 1912, 1938; *longissima*, 1909, 1922, 1923, 1927, 1930, 1934, 1937; *nuda*, 1927; *perennans*, 1927 (and as *U. Avenae* in 1914); *Scabiosae*, 1921, 1925, 1926, 1931, 1932, 1936, 1938 (and as *U. flosculorum* in 1916); *striaeformis*, 1927, 1931, 1932, 1934, 1936, 1937, 1938 (and as *Tilletia de Baryana*, in 1921, 1922); *Tragopogi-pratensis*, 1914; *utriculosa*, 1934; *violacea*, 1909 and eighteen subsequent forays (and as *U. Lychnidis-dioicae*, 1928, 1934).

TILLETIACEAE

Entyloma Calendulae, 1931, 1932, 1933; *microsporum*, 1924, 1927, 1929, 1930, 1930, 1931, 1933, 1936, 1938; *Ranunculi*, 1926, 1926, 1931, 1932, 1934, 1935, 1936, 1938.
Tilletia decipiens, 1808, 1912, 1938; *Holci*, 1938 (and as *T. Rauwenhoffii*, 1937).
Urocystis Anemones, 1907 and twenty-four subsequent forays; *occulta*, 1911; *Violae*, 1911, 1921, 1924, 1927, 1930, 1936, 1938.

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Numbers printed in heavy type indicate the main references to the species concerned.

A SECOND CONTRIBUTION TOWARDS A KNOWLEDGE OF INDIAN USTILAGINALES

FRAGMENTS XXVI–L

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XXVI. *Ustilago vittata* Berkeley

The smut on an Oplismenoid grass collected at Parasnath, Bihar, was named *Ustilago vittata* by Berkeley (1854) and a second collection on *Oplismenus compositus* Beauv. was referred to the same species by E. J. Butler. Butler stated in an unpublished note that the smut is a species of *Tilletia*, and an examination of the type specimen from Herb. Kew., and of the specimen in the Herbarium Cryptogamae Indiae Orientalis, confirms this view. The host of the type has recently been determined at Kew as *Oplismenus compositus*.

Tilletia vittata (Berk.) Mundkur comb.nov.

Ovaricolous, ovaries much inflated. Spores forming a dusty, black spore-mass covered by a hairy layer of coriaceous host tissue; young spores thick-walled, hyaline, mature spores Kaiser Brown to Liver Brown (Ridgway) or opaque, globose with hyaline or slightly tinted, blunt or somewhat curved scales in the form of a band at the circumference, about 1–2·5 μ wide, seen as small papillae in surface view; diameter 13–21 μ with a mean of 16·5 μ.

On an "Oplismenoid grass" [*Oplismenus compositus*, det. C. E. Hubbard] at Parasnath (4000 ft.), Bihar; collected by Hooker before 1854 (Type).

XXVI. (1) Type.

Diameter (μ)	13	14	15	16	17	18	19	20	
Frequency (n)	1	2	15	40	23	14	4	1	=100

Mean = 16·5 μ.

XXVI. (2) Collected by J. S. Gamble on *O. compositus* Beauv. (No. 21801) in February 1890 at Lawsinghi Ghat, Vizagapatam.

Diameter (μ)	14	15	16	17	18	19	20	21	
Frequency (n)	2	27	77	54	20	13	6	1	=200

Mean = 16·7 μ.

XXVI. (3) Collected at Dehra Dun on *O. compositus* Beauv. in 1928.

Diameter (μ)	14	15	16	17	18	19	20	
Frequency (n)	2	12	43	20	11	11	1	=100

Mean = 16·6 μ.

A smut on *Oplismenus Humboldtianus* Nees (= *O. Burmannii* Beauv.) from Costa Rica was identified as *Ustilago vittata* by Charles (1923). An examination of the specimen, kindly sent by Dr J. A. Stevenson, indicates that that smut is also *Tilletia vittata*.

XXVII. *Tilletia indica* Mitra

Germination of the spores of the smut collected on wheat at Karnal and described as a new species by Mitra (1931), resulted in the formation of unbranched, rather long promycelia, each with a whorl of non-fusing primary conidia (primary sterigmata of Buller), 32–128 or more, at the apex. This smut is therefore a *Neovossia*.

Neovossia indica (Mitra) Mundkur comb.nov.

Ovaricolous, only a few grains in an ear attacked; infected kernels not swollen, partially to completely destroyed; when partially attacked, infection is confined to the grooved side, destroying embryo tissue; in advanced attack, tissues along the groove and the adjacent endosperm are replaced by spores. Spore-mass dark brown to black, dusty, held together by the pericarp. Spores formed singly at the ends of mycelial threads, ellipsoidal, or spherical, a few with appendages; Liver Brown (Ridgway) to opaque; epispore with reticulated proliferations, and projecting into a winged margin at the circumference, 3–6 μ in width; lacunae roundish or irregular; total diameter 24–47 μ with a mean of 33·5 μ; spore proper ranging from 18 to 37 μ with a mean of 27·0 μ. Germination by means of a promycelium with a whorl of 32–128 or more sporidia which do not fuse. The spore mass is fetid.

On *Triticum vulgare* Vill., at Karnal; collected, April 1930, by Abdur Rahman Khan; Type at Herbarium Cryptogamae Indiae Orientalis, New Delhi; co-types at Herb. Kew and the Imperial Mycological Institute, Kew.

XXVII. (1) Type.

Diameter (μ)	24	26	32	37	43	47	
Frequency (n)	16	17	72	89	4	2	= 200

Mean = 33·5 μ.

XXVII. (2) Collected at Peshawar in May 1932.

Diameter (μ)	26	32	37	43	49	
Frequency (n)	13	76	82	28	1	= 200

Mean = 35·2 μ.

This bunt usually destroys only part of the kernels whereas *T. foetida* (Wallr.) Liro [= *T. foetans* (B. & C.) Trel. = *T. levis* Kühn] and *T. caries* (DC.) Tul. [= *T. Tritici* (Bjrek.) Wint.] destroy the entire grain. *Neovossia indica* differs from these two species and from

Tilletia triticina Ranjovic and *T. controversa* Kühn in spore size and in the mode of germination of the spores. The hosts of the latter two species are *Haynaldia villosa* (L.) Schur. and *Agropyron repens* Beauv., both of which were once placed in the genus *Triticum*.

XXVIII. *Ustilago burmanica* Syd. & Butl.

A smut attacking the inflorescence of a species of *Ischaemum* was named *Ustilago burmanica* by Sydow & Butler (1912). A determination of the host made at the Royal Botanic Gardens, Calcutta, shows that it is *Ischaemum timorense* Kunth. Another collection on *I. spathiflorum* Hook. f. listed under *Ustilago burmanica* by Butler & Bisby (1931) is not this species.

Ustilago burmanica Sydow & Butler

Culmicolous, entire inflorescence destroyed. Sori at first hidden by the leaf sheath and covered by a membrane made up of host cells but later naked, 0·5–3 cm. long. Spores irregularly globose to ellipsoidal, slightly angular, Carob Brown (Ridgway) with thick but smooth cell wall; diameter 10–17 μ with a mean of 13·2 μ.

On *Ischaemum timorense* Kunth at Kya-in, near Moulmein, Burma; collected by E. J. Butler, 9 January 1908 (no. 1424).

XXVIII. (1) Type.

Diameter (μ)	10	11	12	13	14	15	16	17	
Frequency (n)	3	13	44	62	55	13	9	1	= 200

Mean = 13·2 μ.

Mycelial strands are present in the sori but they are not of the type characteristic of the genus *Farysia*.

XXIX. Another smut on *Polytoca barbata*

A smut collected by I. H. Burkill in the Sipna valley does not agree with *Ustilago Polytocae* Mundkur (1939) nor with the other species of *Ustilago* on allied grasses and is proposed as the type of a new species.

Ustilago Polytocae-barbatae Mundkur sp.nov.

Soris in ovariis evolutis, intra calycem retentis, atro-castaneis, parum inflatis, columella aliquando praeditis. Sporis pulverulentis, in cumulo nigris, globosis vel sub-globosis, "Amber Brown" (Ridgway), epispora tenui, minute et obscure foveolata, prope marginem laevigata praeditis; 6·3–10 μ diam., in medio 8·6 μ.

Hab. in ovariis *Polytocae barbatae* Stapf, Sipna valley, Amraoti, Indiae or. 11 October 1908, leg. I. H. Burkill (Typus).

Ovaricolous. Sori held together by the sepals; blackish brown and not much inflated; sometimes with a columella. Spores pulverulent,

black in mass, spherical to sub-globose, Amber Brown (Ridgway); spore surface minutely, almost imperceptibly, pitted; epispore thin, edge smooth; diameter 6·3–10·9 μ with a mean of 8·6 μ.

On *Polytoca barbata* Stapf [=*Coix barbata* Roxb.=*Chionachne Koenigii* (Spr.) Thw.]; collected by I. H. Burkill in the Sipna valley, Amraoti District (R.E.P. Field no. 31271), 11 October 1908. Type deposited in Herbarium Cryptogamae Indiae Orientalis, New Delhi, and co-type in the Herbarium of the Imperial Mycological Institute, Kew.

XXIX. (1) Type.

Diameter (μ)	6·3	7	8	9	10	10·6	
Frequency (n)	1	31	30	118	18	2	=200

Mean = 8·6 μ.

This smut differs from *Ustilago Polytocae* in the shape of its smaller spores which have a thinner, minutely pitted epispore, without spines. They differ from those of *U. Coicis* in colour, the absence of echinulations, and the smaller size.

XXX. *Doassansia Nymphaeae* Sydow

Doassansia Nymphaeae was collected at Nirmal and described by Sydow (1912). Co-type material is available both at the Herbarium of the Agricultural College at Poona and the Herbarium Cryptogamae Indiae Orientalis, New Delhi.

Doassansia Nymphaeae Syd.

Petiolicolous, forming large hemispherical tumours, 5–16 mm. long; spore-balls nearly globular to elliptical, 150–235 μ in diameter, enclosed in a tegument; cortical cells slender, yellowish brown, elliptical-oblong, 12·3–17·1 μ long and 6·4–10·5 μ broad; sporidia in whorls of four to six, spindle-shaped, cylindrical.

In the petioles of *Nymphaea stellata* Willd. at Nirmal, near Bassein; collected by H. M. Chibber, 18 February 1912. It has not been reported since from India or elsewhere.

XXXI. The leaf smut of *Alisma plantago* L.

A leaf smut of *Alisma plantago* was determined by Sydow & Butler (1912) as *Doassansia Alismatis*. The specimen agrees with Sydow's Ustilagineen Exsiccaten nos. 186 and 413 but differs slightly in colour and spore size from his Exsiccata nos. 49 and 285.

Doassansia Alismatis (Nees) Cornu

Sori foliicolous, forming yellowish spots which eventually become brownish red; spots subcircular to irregular, 5–12 mm. wide. Spore-balls subcuticular in the palisade or spongy parenchyma, globose or

irregular, flattened against one another, 120–250 μ in diameter. Cortex distinct; cortical cells prominent, radially elongated, 12–26 × 5–14 μ, blunt at both ends, with uniform, dark brown, smooth membranes. Spore-mass completely filling the interior. Spores loosely adpressed, light coloured, ellipsoidal to spherical, some polyhedral, with thick smooth walls; diameter 7–14 μ with a mean of 10·7 μ.

On *Alisma plantago* L. at Achibal (5800 ft.), Kashmir; collected by E. J. Butler (no. 1447), 2 September 1908.

XXXII. The leaf smut of *Potamogeton*

A smut on a species of *Potamogeton* was named *Doassansia Martianoffiana* (Thüm.) Schroet. by Sydow & Butler (1912). This is the only record of this fungus in India and the specimen agrees with Sydow's Ust. Exs. no. 363 and Myc. Germ. no. 2293.

Doassansia Martianoffiana was placed in a subgenus, *Doassansiopsis*, by Setchell (1892), because the central portion of the spore-balls, instead of being filled with fertile spores, is made up of sterile pseudoparenchymatous cells which are surrounded by a single layer of fertile cells. The subgenus was raised to generic rank by Dietel (1897), but is credited to Setchell by Schellenberg (1912), Ciferri (1938) and Liro (1938).

Doassansiopsis Martianoffiana (Thüm.) Diet.

Foliicolous; sori forming circular, convex spots in the mesophyll; at first yellowish but eventually reddish brown; often merged into indefinite areas covering a large part of the leaves; sometimes also in the petioles. Spore-balls globose to subspherical, 70–250 μ in diameter, consisting of a distinct cortex surrounding a single layer of fertile cells within which is a central mass of pseudo-parenchymatous cells. Cortical cells polygonal, brown, small, 5–8 μ in diameter. Spores ellipsoidal to prismatic, 10–13 μ long, 5–11 μ broad, with pale brown, smooth membrane. Central pseudo-parenchymatous tissue pale yellow and fairly large celled.

On floating leaves of *Potamogeton* sp. in Wular lake, Kashmir; collected by E. J. Butler (no. 1448), 17 September 1908.

XXXIII. *Tolyposporium globuligerum* (B. & Br.) Ricker

This smut on *Leersia hexandra* Swartz, collected in Assam by N. L. Bor, has been compared with the type specimen of *Testicularia Leersiae* Cornu obtained through the courtesy of Dr Roger Heim of the Muséum d'Histoire Naturelle, Paris. According to Cornu (1883) the smut was at first named *Ustilago Leersiae* by Durieu and sent to Tulasne, but the name was never effectively published. Cornu stated that the spore-balls consisted of an external layer of fertile cells with a

central mass of pseudo-parenchymatous cells and named it *Testicularia Leersiae*. Ricker (1905) compared the smut with Berkeley & Broome's (1880) *Thecaphora globuligera* and correctly referred them both to *Tolyposporium* as *T. globuligerum*.

Tolyposporium globuligerum (B. & Br.) Ricker

Ovaricolous; sori subglobose or oblong, 2–3 mm. long, covered by a greenish, smooth membrane, rupturing first at the apex and revealing a black granular spore mass; spore-balls black, opaque, globose to oblong, irregular, firm, 65–210 μ long, 36–108 μ broad, composed of several spores. Spores subglobose, angular, generally polygonal, with dark reddish brown folds of outer coat showing as reticulations, or upon rupture as blunt processes or tubercle-like projections; diameter 6·8–11·5 μ, with a mean of 8·9 μ.

On *Leersia hexandra* Swartz (= *Homalocenchrus hexandrus* O. Kuntze) in Assam; collected by N. L. Bor, 26 November 1936. Also on Dacca Farm, Bengal.

XXXIII. (1) Collected by N. L. Bor in Assam, 1936.

Diameter (μ)	6·8	7	8	9	10	11	11·5	
Frequency (n)	9	19	22	92	45	7	6	= 200

Mean = 8·9 μ.

XXXIII. (2) Collected by P. C. Kar, Dacca, Bengal, 1939.

Diameter (μ)	7	8	9	10	10·4	
Frequency (n)	22	37	117	22	2	= 200

Mean = 8·7 μ.

Dimensions of the spores of the type specimen, collected by M. Letourneux in August 1862 in Algeria and determined by Cornu, are as follows:

Diameter (μ)	7	8	9	10	11	
Frequency (n)	4	13	51	26	6	= 100

Mean = 9·1 μ.

XXXIV. A NEW SPECIES OF *TILLETIA* ON *PANICUM*

This smut was collected by K. Bagchee at Calcutta in January 1928 and I (1938) identified it as *Tilletia Ayresii* Berk., but a comparison with the type specimen has shown that it is not that species. The specimen has also been compared with several other species of *Tilletia* reported on species of *Panicum*. It agrees with none of these and is therefore proposed as new.

Tilletia Panici Mundkur sp.nov.

Soris nonnulla ovaria quae dilatantur inficientibus, membrana coriacea, fulva vel atrogrisea, pilis albidis ornata cinctis, ad 18 mm. altis, 6 mm. latis. Sporis subpulverulentis, solitariis, per tempora

diversa maturantibus, cellulis sterilibus hyalinis intermixtis, "Brick Red ad Hessian Brown" [Ridgway] interdum sub-opacis; globosis vel sub-globosis, minute irregulariterque areolatis, prope marginem ergo asperatis; epispora 1·5–2·5 μ lata, cingulo hyalino destituta praeditis; 13·0–19·5 μ diam., in medio 15·8 μ.

Hab. in ovariis *Panici* spec. Calcutta, Indiae or. Leg. K. Bagchee, Ianuarius, 1928 (Typus).

Ovaricolous, only a few ovaries in a panicle attacked; infected ovaries inflated, up to 18 mm. long and 6 mm. broad; covered by a buff to dark grey, coriaceous membrane with silvery white hairs on the outside. Spores semi-dusty, solitary, in various stages of development, intermixed with sterile hyaline cells; Brick Red to Hessian Brown (Ridgway) to almost opaque; spherical to subglobose with minute, irregular, areolate spaces giving the edge a rough appearance; epispore 1·5–2·5 μ thick, without a hyaline band; diameter 13·0–19·5 μ with a mean of 15·8 μ.

On a species of *Panicum* at Calcutta; collected by K. Bagchee, January 1928. Type deposited in Herbarium Cryptogamae Indiae Orientalis, New Delhi and co-type in Herbarium of the Imperial Mycological Institute, Kew (material very scanty).

XXXIV. (1) Type of *Tilletia Panici.*

Diameter (μ)	13·0	14·0	15·6	16·9	18·2	19·5	
Frequency (n)	23	28	51	90	7	1	= 200

Mean = 15·8 μ.

This species differs from *T. Ayresii* in possessing larger deeper brown spores, in having irregular areolate spaces and in the absence of minute warts. Wakefield (1920) suggested the merging of *T. Ayresii* into *Ustilago heterospora* and a comparison of the type specimens of the two species confirms this view. The dimensions of the spores are as follows:

Tilletia Ayresii Berk. on *Panicum maximum* Jacq. Type specimen from Herb. Kew.

Diameter (μ)	11	12	13	14	15	16	
Frequency (n)	3	10	28	41	17	1	= 100

Mean = 13·6 μ.

Ustilago heterospora P. Henn. (= *Tilletia heterospora* Zundel) on *Panicum maximum* Jacq. Type specimen from Mus. Bot. Berol.

Diameter (μ)	11	12	13	14	15	16	
Frequency (n)	3	11	20	45	20	1	= 100

Mean = 13·7 μ.

Tilletia Panici has been compared with the type specimens of *T. courtetiana* Har. & Pat. and *T. verrucosa* Cooke & Massee and with the authentic specimens of *T. pulcherrima* Ell. & Gall. and *T. Maclagani* (Berk.) Clinton.

T. courtetiana has perfectly spherical, brownish black spores with a reticulate epispore, subpentangular alveoli, 4 μ in diameter, and the following dimensions of spores.

T. courtetiana Pat. & Har. on *Panicum proliferum* Lam. Type specimen.

Diameter (μ)	18·6	20·5	22·3	24·2	
Frequency (n)	3	42	50	5	= 100

Mean = 21·5 μ.

Tilletia verrucosa has globose to subglobose spores of yellowish brown colour, bristling with acute, pyramidal warts about 3 μ high and the following dimensions of spores.

Tilletia verrucosa Cooke & Massee on *Panicum coloratum* Nees (= *P. Swynnertonii* Rendle). Type.

Diameter (μ)	16·8	18	19·3	20·5	21·8	23·1	24·4	
Frequency (n)	4	9	22	52	9	3	1	= 100

Mean = 20·1 μ.

Tilletia pulcherrima has opaque, spherical to subspherical spores with a more or less evident hyaline membrane bearing truncate, scale-like projections 2 μ thick and the following dimensions of spores.

Tilletia pulcherrima Ell. & Gall. on *Panicum capillare* L. (Seymour and Earle, Econ. Fungi, C. 52).

Diameter (μ)	18·6	22·3	26·0	29·8	
Frequency (n)	7	24	59	10	= 100

Mean = 25·0 μ.

Tilletia Maclagani attacks both the ovaries and the anthers; its spores are light to dark reddish brown, more elongate and somewhat irregular in size, the epispore is 3–4 μ thick bearing minutely areolate pits, and spores have the following dimensions:

Tilletia Maclagani (Berk.) Clinton on *Panicum virgatum* Roxb. (Seymour and Earle, Econ. Fungi, Suppl. C. 126).

Diameter (μ)	16·8	18·0	19·3	20·6	21·8	23·1	24·4	
Frequency (n)	2	16	24	50	5	2	1	= 100

Mean = 19·9 μ.

Tilletia Panici differs from all these four species, none of which has so far been recorded from India.

XXXV. *Ustilago endotricha* Berk.

Ustilago endotricha was described by Berkeley (1854) on *Gahnia* sp. collected at Auckland, New Zealand, by Dr R. H. Sinclair. The smut collected in India on *Carex condensata* Nees by Hooker was also placed in this species by Berkeley with the remark that the spores of the Indian specimen were much smaller than those of the collections from Ceylon and New Zealand. An examination of the type and the two Indian collections, kindly made available by the Director, Royal

Ustilago consimilis Sydow

Culmicolous, completely destroying the inflorescence and part of the axis; sorus covered by the leaf-sheath, not extending into a long flagelliform structure; columella present and vestiges of a membrane made up of host tissue. Spores black in mass, dusty, spherical to slightly oval, Chestnut (Ridgway) with thick epispore, margin and spore surface smooth; diameter 3·7–6·2 μ with a mean of 5·0 μ.

On *Sclerostachya fusca* (Roxb.) A. Camus (see below), Sibsagar, Assam; collected by B. C. Basu, 18 December 1910. A second collection was made by T. N. Sen, January 1938, on (?) "*Erianthus Ravennae*" Beauv.

XXXVII. (1) *Ustilago consimilis* Syd. Co-type.

Diameter (μ)	3·7	4	5	6·2	
Frequency (*n*)	7	13	150	30	= 200

Mean = 5·0 μ.

XXXVII. (2) Collected by T. N. Sen in January 1938 on "*Erianthus Ravennae* Beauv." (see below).

Diameter (μ)	3·5	4	5	6·3	
Frequency (*n*)	9	26	119	46	= 200

Mean = 5·1 μ.

When he sent the original specimen, B. C. Basu stated that the host was called "Ikra" grass and the name *Saccharum fuscum* was supplied at the time by the Royal Botanic Gardens, Calcutta. Dr N. L. Bor, an authority on Assam grasses, states, however, that the name "Ikra" is applied to a robust variety of *S. spontaneum* L. The host of the second specimen was identified as *Erianthus Ravennae* Beauv. but this grass does not occur in Assam, according to Bor. Possibly this host is also *Saccharum spontaneum* L.

XXXVIII. *Ustilago scitaminea* Syd.

As a result of a critical examination of the culmicolous smuts attacking *Saccharum officinarum* L. and *S. Barberi* Jesw., I (1939*b*) concluded that they really formed one species and two varieties. The diagnosis of *Ustilago scitaminea* given by Sydow has been somewhat emended.

Ustilago scitaminea Syd.

Culmicolous, greatly altering the floral axis; sorus extending into a long, curved, flagelliform structure, at first covered by a delicate membrane of host tissue, later naked; lower part hidden by the leaf-sheath; columella present. Spores powdery, black in mass, spherical to subglobose, Rood's Brown to Prout's Brown (Ridgway) with thin

epispore and smooth margin; spore surface very minutely punctate; diameter 5·5–9·7 μ with a mean of 7·3 μ.

On *Saccharum officinarum* L. and *S. Barberi* Jesw. in India, Java, Burma and South Africa.

XXXVIII. (1) Collected on sugarcane on Manjri Farm, Poona, by E. J. Butler on 25 October 1905.

Diameter (μ)	5·7	6	7	8	9·1	
Frequency (*n*)	3	18	117	45	17	=200

Mean = 7·3 μ.

Ustilago scitaminea Syd. var. ***Sacchari-Barberi*** Mundkur

The diagnosis is as for *Ustilago scitaminea* except that the spores are Mummy Brown (Ridgway) with a thicker epispore, slightly rough margin and very minutely verrucose spore surface; diameter 5·1–8·0 μ with a mean of 6·6 μ.

On *Sacchari Barberi* Jesw. and *S. officinarum* L. at Partabgarh, Amritsar, Karnal, Lyallpur and Sepaya. On *S. spontaneum* L. at Pusa and Hoshangabad.

XXXVIII. (2) Collected on sugarcane by Hafiz Khan at Amritsar, 13 October 1907.

Diameter (μ)	5·1	6	7	8	
Frequency (*n*)	1	82	108	9	=200

Mean = 6·6 μ.

Ustilago scitaminea Syd. var. ***Sacchari-officinarum*** Mundkur

The diagnosis is as for *Ustilago scitaminea* except that the spores are Vandyke Brown (Ridgway) with a medium thick, coarsely echinulate epispore, and a diameter of 6·5–11·3 μ, with a mean of 8·3 μ.

On *Saccharum officinarum* L. in Sambalpur; collected on 9 June 1904.

XXXIX. A SMUT ON *NEYRAUDIA ARUNDINACEA* (L.) HENRY

This smut was sent to me by N. L. Bor from the Botanical Gardens, Dehra Dun. It does not agree with any smut reported on the section *Poaceae* of the tribe *Eragrostis* and is proposed as a new species.

Ustilago Neyraudiae Mundkur sp.nov.

Soris ovaria inflata, e glumis nonnullarum spicularum dealbatarum manifeste protrudentia inficientibus; membrana viridi coriacea cinctis; columella carentibus; massam sporarum primo aliquanto agglutinatam, dein pulverulentam includentibus. Sporis ellipticis, globosis vel irregularibus, epispora crassa, laevi vel obscure granulata praeditis; "Carob Brown" [Ridgway]; 6·7–11·9 μ diam., in medio 9·2 μ.

Hab. in ovariis *Neyraudiae arundinaceae* (L.) Henry, Dehra Dun, Indiae or. 6 October 1938, leg. N. L. Bor.

Ovaricolous, affected spikelets whitish, only a few spikelets in a panicle attacked. Ovaries inflated, protruding prominently out of the glumes. Sori covered by a greenish coriaceous membrane of host tissue; no columella. Spore-mass black, slightly agglutinated but later dusty. Spores ellipsoidal to globose or sometimes irregular, epispore thick, smooth or with very obscure granulations on surface, Carob Brown (Ridgway); diameter 6·7–11·9 μ with a mean of 9·2 μ.

On *Neyraudia arundinacea* (L.) Henry (= *N. madagascariensis* Hook. f.) at Dehra Dun; collected by N. L. Bor on 6 October 1938. Type deposited in the Herbarium Cryptogamae Indiae Orientalis, New Delhi, co-types in Herbarium of the Imperial Mycological Institute, Kew and Herb. Kew.

XXXIX. (1) Type.

Diameter (μ)	6·7	8	9	10	11	11·9	
Frequency (n)	6	29	94	51	17	3	= 200

Mean = 9·2 μ.

XL. *Tolyposporium Penicillariae* Brefeld

This species was described by Brefeld (1895) on *Penicillaria spicata* Willd. (= *Pennisetum typhoides*) sent to him by A. Barclay. A fragment of the type specimen was kindly sent by Dr E. Ulbrich, of the Berlin Botanical Museum, where Brefeld's Herbarium is deposited. The label on the type specimen states "Von Barclay erhalten aus Indien, II 1891".

Collections of this smut have since been made on *P. typhoides* (Bajra) at Coimbatore, Nadiad, Pusa, Sialkot and elsewhere.

Tolyposporium Penicillariae Bref.

Ovaricolous, only few ovaries in an ear attacked; smutted ovaries enlarged into oval or pear-shaped bodies 3–4 mm. long and 2–3 mm. broad, bluntly rounded or conical at the apex; sori chocolate-brown, covered by a tough membrane composed of host tissue, crumbling into coarse black powder, formed mostly of roundish spore-balls. Spore-balls of unequal size, from 40–140 μ in diameter, consisting of several spores tightly pressed together and breaking apart with difficulty. Spores oval, ellipsoidal, some spherical, Antimony Yellow to Yellow Ochre (Ridgway) with a thin spore wall and smooth surface; diameter 6·5–12·3 μ with a mean of 9·3 μ; spore contents granular.

On *Pennisetum typhoides* Stapf & Hubbard (Bajra); collected by A. Barclay in India about 1891. Also at Pusa, Coimbatore, Nadiad,

Ahmedabad and Sialkot; known to occur in Sind, United Provinces and the Punjab.

XL. (1) Type from Mus. Bot. Berol., collected by A. Barclay in India.

Diameter (μ)	6·5	7	8	9	10	11	12·3	
Frequency (n)	1	4	21	104	48	14	8	=200

Mean = 9·3 μ.

The remark by Butler & Bisby (1931) that the Bajra smut occurring in the plains does not agree with Brefeld's description, is true only of the smut on this millet from Poona, which is dealt with separately (No. XLI).

Tolyposporium Penicillariae was recorded by Yen (1938) from Africa, where it was collected on *Pennisetum typhoides* (?) at Ouadai, Tehad. The spore-balls are stated to be blacker and slightly larger than those of a German specimen at Paris but spore characters are reported as identical. These were not described nor were comparative measurements given, and it is not certain that the German specimen referred to was the type. As another species of *Tolyposporium* occurs on bulrush millet (*Pennisetum leonis* Stapf & Hubbard) in Africa, in a locality not far from Tehad, a re-determination of Yen's specimen seems desirable. Yen germinated the spores without any difficulty, which does not agree with the experience of Brefeld (1895) and Butler (1918).

XLI. *Tolyposporium senegalense* Speg.

The smut collected at Poona on Bajra (*Pennisetum typhoides*) was referred to the species *Tolyposporium Penicillariae* Bref. by Sydow and Butler (1907) with the remark that it did not agree with the diagnosis of that species given by Brefeld (1895). A comparison with the type specimen of *T. Penicillariae* reveals that there are considerable differences between the two smuts. The Poona specimen agrees in general with *T. senegalense* except that the latter is reported to have slightly larger spore-balls; the spore size, 8–10 × 6–10 μ, is within the range obtained by me. A comparison with the type or other authentic specimen has not been possible.

Tolyposporium senegalense Spegazzini

Ovaricolous, only a few ovaries in an ear attacked; infected ovaries inflated, ellipsoidal, truncated at apex, black. Sori covered by a rigid, brownish black membrane made up of host tissue; no columella; finally crumbling into numerous spore-balls. Spore-balls black, nearly smooth, not easily breakable, ellipsoid-ovoid or irregular, 37–126 × 34–92 μ. Spores globose, ellipsoidal, angled, some irregular, Vandyke Brown to Liver Brown (Ridgway) with rather thick, faintly

areolate epispore, smooth surface and margin, some with folds; diameter 5·7–9·7 μ with a mean of 7·6 μ.

On *Pennisetum typhoides* Stapf & Hubbard at Poona; collected by the Farm Superintendent in 1906 and received at Pusa on 5 February 1907.

XLI. (1) Butler's no. 886, collected at Poona in 1906.

Diameter (μ)	5·7	6	7	8	9	9·7	
Frequency (*n*)	2	15	93	45	43	2	= 200

Mean = 7·6 μ.

Two collections of a smut on the African bulrush millet (*Pennisetum leonis* Stapf & Hubbard), collected by F. C. Deighton in Sierra Leone, have also been critically examined. They agree in all major respects with *Tolyposporium senegalense* excepting that the spore-balls are 25–85 × 24–61 μ and less firm, while the spores are faintly lighter. These two collections come from very close to the type locality of *Tolyposporium senegalense* and belong to that species.

T. senegalense, collected on *Pennisetum leonis* by F. C. Deighton at Kambia, Sierra Leone on 28 December 1927. No. M 175.

Diameter (μ)	6·3	7	8	9	10	11	
Frequency (*n*)	2	47	90	32	25	4	= 200

Mean = 8·2 μ.

A specimen from Njala, Sierra Leone, was referred by Ciferri (1931, p. 57) to *Ustilago Penniseti* Rabenh. The host was *Pennisetum leonis* (a species not described until 1933), but was sent as *P.* ?*typhoideum*. It is evident that this smut is not the same as the type of *Ustilago Penniseti* Rabenhorst (1871), here redescribed from the specimen in Herbarium G. Winter, kindly sent by Dr E. Ulbrich.

Ustilago Penniseti Rabenhorst

Ovaricolous, smutted ovaries slightly swollen; sori black, covered by a membrane of host tissue; a columella may be present, but it is not distinct. Spores pulverulent, solitary; black in mass, globose to ellipsoidal, Liver Brown (Ridgway), very faintly echinulate with a thick epispore; diameter 8·9–13·8 μ with a mean of 11·2 μ.

On *Pennisetum fasciculatum* Trin. at Marasch, Iran; collected by C. Haussknecht, 15 July 1865. Dimensions of the spores of the type are as follows:

Diameter (μ)	8·9	10	11	12	13	13·8	
Frequency (*n*)	3	28	32	37	8	2	= 110

Mean = 11·2 μ.

De Toni (1888) cited *Uredo* (*Ustilago*) *trichophora* var. *Penniseti* Kunze as a synonym of Rabenhorst's smut, gave a larger host range, included Egypt and Madeira Isles as localities and gave the spore

diameter as 5·5–12 μ; the type locality is not even mentioned. De Toni is thus responsible for some of the confusion in the identification of smuts on *Pennisetum*.

XLII. A NEW SMUT ON *COIX LACHRYMA-JOBI* L.

Smutted racemes of *Coix Lachryma-Jobi* collected by S. L. Ajrekar are labelled *Ustilago Coicis* Brefeld in the Herbarium Cryptogamae Indiae Orientalis, but the specimen does not agree with *Ustilago Coicis* or with the smuts reported on related genera and is therefore proposed as a new species.

Ustilago Lachrymae-Jobi Mundkur sp.nov.

Soris ovaria nonnulla inficientibus, eaque omnino destruentibus, magnis, funebre castaneis, glumis cinctis; columella carentibus. Sporis levibus, "Diamine Brown" [Ridgway], irregulariter globosis vel ellipticis, angulatis, epispora tenui praeditis; 7–15 μ diam., in medio 11·4 μ.

Hab. in ovariis *Coicis Lachrymae-Jobi* L. Girnar, Junagadh, Indiae or. 19 September 1913, leg. S. L. Ajrekar (Typus).

Ovaricolous, not all ovaries in a raceme affected; smutted ovaries entirely destroyed, male flowers not attacked. Sori large, deep brown, covered by the glumes and without columella. Spores smooth, Diamine Brown (Ridgway), irregularly globose to ellipsoidal or angled, with thin cell-wall, giving the spores a crumpled appearance; diameter 7–15 μ with a mean of 11·4 μ.

On *Coix Lachryma-Jobi* L. on Girnar Hills, Junagadh; collected by S. L. Ajrekar, 19 September 1913. Type specimen deposited in the Herbarium Cryptogamae Indiae Orientalis and co-type in the Herbarium, Imperial Mycological Institute, Kew.

XLII. (1) Type.

Diameter (μ)	7	8	9	10	11	12	13	14	15	
Frequency (*n*)	1	4	23	23	52	55	21	16	5	= 200

Mean = 11·4 μ.

The spores of this smut differ from those of *Ustilago Coicis* in possessing a smooth and thin epispore, in their irregular shape and larger size.

Since *U. Coicis* was reported by me (1939*a*) a specimen of *Coix Lachryma-Jobi* collected at Shillong by H. Collet on 3 October 1890 became available for examination through the kindness of Dr K. Biswas, Superintendent, Royal Botanic Gardens, Calcutta. Some of the ovaries of the specimen were attacked by *Ustilago Coicis*. The measurements are given below.

XLII. (2) Collected by H. Collet at Shillong.

Diameter (μ)	7	8	9	10	11	12	
Frequency (n)	7	12	117	53	9	2	=200

Mean = $9{\cdot}2\,\mu$.

U. Coicis has been reported on the same host by Raciborski (1900) from Java. His description agrees with that of the type specimen but material was not available at Buitenzorg and none could be obtained from his herbarium at Cracow, Poland.

U. Coicis was found by Thomas (1920) on *Coix Lachryma-Jobi* in the quarantine-house at Washington, D.C., on plants from seed received from the Philippines where, presumably, the smut also occurs. A fragment of this smut accompanied by *Ustilago Coicis* on *Coix agrestis* collected by S. Kusano, 16 September 1904, in Japan and distributed in Vestergren, *Micromycetes rariores selecti* (no. 1141) was kindly sent by Dr J. A. Stevenson of the U.S. Department of Agriculture. The fungi have been compared with the type specimen with which they agree in all respects.

A smut on *Coix agrestis* Lour. has been identified as *Ustilago Coicis* and reported by Tai (1937) from China. Examination of a specimen sent by him indicates that it is an undescribed species of *Tilletia.*

Tilletia Taiana Mundkur sp.nov.

Soris inflorescentiam totam destruentibus, in vagina pro parte occlusis, massam sporarum atrocastaneam ad nigram includentibus. Sporis globosis vel ellipticis, epispora areolas polygonales vel elongatas, lineolis $2{\cdot}3\,\mu$ crassis, $1{\cdot}5\,\mu$ altis limitatas exhibenti praeditis; "Brownish-Olive" [Ridgway]; $10{\cdot}0$–$16{\cdot}0\,\mu$ diam., in medio $13{\cdot}2\,\mu$.

Hab. in inflorescentiis *Coicis agrestis* Lour.; Yunan, Sina 20 November 1938, leg. T. H. Wang (Typus).

Entire inflorescence destroyed; sori partly concealed by the sheath; spore-mass dark brown to black, pulverulent. Spores globose to oval, rarely ellipsoidal, with polygonal or rarely elongate reticulations ($2{\cdot}3\,\mu$ wide and $1{\cdot}5\,\mu$ deep), showing as projections at the circumference; enveloping membrane absent; Brownish Olive (Ridgway); diameter $10{\cdot}4$–$16{\cdot}3\,\mu$ with a mean of $13{\cdot}2\,\mu$. Chains of sterile cells with thick walls and light brown colour present. Germination by means of a slender promycelium resulting in an apical whorl of twenty to twenty-two primary conidia; fusion not observed.

On *Coix agrestis* Lour. at Yunan, China; collected by T. H. Wang on 20 November 1938. Type deposited in the Herbarium Cryptogamae Indiae Orientalis, New Delhi, and co-type in Herbarium, Imperial Mycological Institute, Kew.

Type. *Tilletia Taiana* on *Coix agrestis* Lour.

Diameter (μ)	10	11	12	13	14	15	16	
Frequency (n)	5	11	39	76	37	22	10	=200

Mean = 13·2 μ.

Ciferri (1934) limits the genus *Tilletia* to the ovaricolous smuts but *Tilletia Taiana* destroys the entire inflorescence. Its spore characters and germination leave no doubt regarding its position in that genus and the limitation which Ciferri proposes is not therefore justified.

XLIII. *Ustilago Hordei* (Pers.) Lagerheim

Ustilago Hordei occurs wherever barley is grown in India. There are several collections in the Herbarium Cryptogamae Indiae Orientalis all of which have been compared with exsiccatae (Sydow's Ustilagineen, no. 207, Briosi and Cavara's Funghi Parassiti, no. 401 and no. 62, 63, 64 and 65 of the Mycological Exchange of the U.S. Department of Agriculture), with which they agree.

Ustilago Hordei (Pers.) Lagerh.

Sori in spikelets forming a black-brown, compact spore-mass covered, usually permanently, by the transparent basal parts of the glumes. Spores adhering, globose to ellipsoid, often somewhat angular by pressure, Carob Brown (Ridgway) but slightly lighter coloured on one side indicating a thinner wall, smooth; diameter 5·5–8·7 μ with a mean of 6·8 μ (elongate spores, 9–11 μ, reported, but not seen in Indian specimens).

On cultivated barley (*Hordeum*) throughout India.

XLIII. (1) *Ustilago Hordei* on cultivated barley.

Diameter (μ)	5·5	6	7	8	8·7	
Frequency (n)	6	49	124	18	2	=199

Mean = 6·8 μ.

Two other smuts have also been reported on barley by Tapke (1932) and Ruttle (1934), *Ustilago nigra* Tapke and *U. medians* Biedenkopf. These have been separated from *U. Hordei* and *U. nuda* by the colour of the spore-mass, spore characters, mode of germination and of infecting the host. None of the Indian collections of *U. Hordei* agree with the exsiccata of these species, kindly supplied by Dr V. F. Tapke and Mrs M. L. Ruttle.

XLIV. *Tilletia tumefaciens* Syd.

This remarkable smut which causes enormous galls on the host was named *Tilletia tumefaciens* by Sydow in Sydow & Butler (1912). The entire growing portion including the young leaves, stem and panicle are converted into a large hood-shaped gall. The type specimen,

which is very scanty, was deposited by Sydow in the Herbarium Cryptogamae Indiae Orientalis.

Tilletia tumefaciens Syd.

Sori developing in the apical region converting the stem, bud-leaves and panicle into large hood-shaped galls, up to 8 cm. long and 2 cm. broad and filled with rust-coloured, powdery spores. Spores globose, in various stages of development, immature ones Ferruginous (Ridgway) and mature ones Kaiser Brown (Ridgway); diameter 17–23 μ with a mean of 20·6 μ; episporc 3–4 μ thick, covered with a network of raised, five- to six-angled reticulations, 2·5 μ high and 4–7 μ broad, with a smooth hyaline membrane covering the spores.

On *Panicum antidotale* Retz., at Lyallpur; collected by D. Milne, 30 September 1909 (Type).

XLIV. (1) Type.

Diameter (μ)	17	19	21	23	
Frequency (n)	2	15	23	10	= 50

Mean = 20·6 μ.

XLV. *Ustilago Ahmadiana* Syd.

Ustilago Ahmadiana Sydow was the name given by Sydow (1938) to a smut on *Polygonum rumicifolium* collected by Mr S. Ahmad. A part of the co-type (no. 3*a*) became available for examination through the courtesy of the collector.

Ustilago Ahmadiana Syd.

Ovaricolous, almost entirely destroying the ovaries but spores held together by a tough membrane made up of host tissue. Spore-masses flesh coloured or pale reddish brown and powdery. Spores spherical to subspherical, some ellipsoidal or elongate; Pale Vinaceous-Lilac to Pale-Lilac (Ridgway); spore membrane thin with five- to six-angled compartments on the surface caused by reticulations; each compartment 1·5–2·0 μ; reticulations subhyaline to slightly pinkish, 1 μ in height; diameter 7·8–11·3 μ with a mean of 8·9 μ.

On *Polygonum rumicifolium* Royle in Rotang Pass, Kulu; collected in 1936 by S. Ahmad.

XLV. (1) *Ustilago Ahmadiana*. Co-type (no. 3*a*).

Diameter (μ)	7·8	8	9	10	11·3	
Frequency (n)	10	23	97	5	5	= 140

Mean = 8·9 μ.

Sydow (1938) remarks that the smut is closely related to *Ustilago carnea* Liro and *U. anomala* J. Kunze. A comparison with these species distributed by Sydow [Ustilagineen no. 1 and 376—the former is

U. carnea according to Liro (1924)] shows that *U. Ahmadiana* differs from both in size and colour of spores.

XLVI. Leaf smut on *Papaver Rhoeas* L.

A smut on *Papaver Rhoeas* collected at Lahore on 11 July 1939 by B. B. L. Dutta and G. Singh was sent to the Herbarium Cryptogamae Indiae Orientalis for identification. It agrees very well with the exsiccata of the leaf-smut on this host distributed by Sydow (Ustilagineen no. 86 and 320) under the name *Entyloma bicolor* Zopf. The name *E. bicolor* is, however, a synonym of *E. fuscum* Schroet.

Entyloma fuscum Schroet.

Sori in leaves forming irregular, whitish, yellowish, grey spots, later brown and dried up. Spores more or less irregularly globose to ellipsoidal, Sudan Brown to Brussels Brown (Ridgway); endospore uniformly developed, thin, hyaline to rusty coloured or weakly yellow; exospore uniformly thick, indistinctly two or three layered, the external layer yellow-brown, the inner bright yellow, both together usually 2–3 μ, in places up to 5–6 μ thick; diameter 11·2–18·6 μ with a mean of 14·6 μ.

On *Papaver Rhoeas* L. at Lahore; collected by B. B. L. Dutta and G. Singh on 11 July 1939.

XLVI. (1) *Entyloma fuscum* Schroet. Lahore.

Diameter (μ)	11·2	13	15	17	18·6	
Frequency (n)	13	43	118	19	7	=200

Mean = 14·6 μ.

XLVII. A new smut on *Euphorbia dracunculoides* Lamk.

Mr Sultan Ahmad sent me for determination some smutted seeds of *Euphorbia dracunculoides*, collected by him at the Rice Experiment Station, Kalashakaku, Punjab. The smut is a new species of *Ustilago*, for which the name *U. Euphorbiae* is proposed. No smut has previously been described on any species of the family Euphorbiaceae, nor indeed of the order Euphorbiales.

Ustilago Euphorbiae Mundkur sp.nov.

Soris fructices inficientibus seminaque destruentibus. Massa sporarum castanea vel nigra, in pericarpio sine columella inclusa, dein pulverulenta. Sporis globosis, ellipticis vel aliquando irregularibus, epispora tenui, laevi praeditis; "Vinaceous-Buff" ad "Vinaceous-Fawn" [Ridgway], 3·7–9·3 μ diam., in medio 5·8 μ.

Hab. in fructices *Euphorbiae dracunculoidis* Lamk., Kalashakaku, Punjab, Indiae or.; legit Sultan Ahmad, 18 August 1936.

Fructicolous, endosperm, cotyledons and embryo entirely destroyed, testa intact. Spore-mass deep chocolate-brown to black, firmly held together by the pericarp, later dusty, without columella. Spores spherical, oval or irregularly ellipsoidal; epispore thin, smooth, slightly darker brown; colour "Vinaceous-Buff to Vinaceous-Fawn" [Ridgway]; diameter 3·7–9·3 μ with a mean of 5·8 μ.

On *Euphorbia dracunculoides* Lamk. at Kalashakaku, Punjab; collected by S. Ahmad on 18 August 1936. Type deposited in the Herbarium Cryptogamae Indiae Orientalis, New Delhi, co-types in Kew Herbarium, and Herbarium, Imperial Mycological Institute, Kew.

XLVII. (1) Type.

Diameter (μ)	3·7	4	5	6	7	8	9	9·3	
Frequency (n)	3	6	66	82	30	9	3	1	= 200

Mean = 5·8 μ.

Attempts to germinate the spores proved unsuccessful.

XLVIII. *Entyloma Dahliae* Syd.

Leaves of *Dahlia coccinea* Desf. (horticultural variety) affected by yellowish to medium brown and withered looking spots, collected on 10 January 1936 in the Victoria Gardens, Bombay, were found to be attacked by a species of *Entyloma*. Two species of this genus are known to attack species of *Dahlia*, viz. *Entyloma Dahliae* Syd. (1912) and *E. Unamunoi* Ciferri (1925). Type or authentic specimen of the latter was not available but an authentic specimen of *E. Dahliae* was kindly sent by Dr I. B. Pole-Evans (who had originally collected the type specimen in Natal) with which the Indian specimens agree very well.

Entyloma Dahliae Syd.

Foliicolous, forming amphigenous spots 1–10 mm. wide at first dirty white, later yellowish brown, orbicular to elliptical, definite and conspicuous. Spores irregularly globose smooth, Yellow Ochre to Buckthorn Brown (Ridgway); diameter 9·3–15·6 μ with a mean of 12·7 μ, epispore 1·5–2·5 μ thick. Conidia not seen.

On *Dahlia coccinea* Desf. in the Victoria Gardens, Bombay; collected by B. B. Mundkur, 10 January 1936. On *Dahlia* sp. at Mussoorie; collected by G. Watts Padwick, 24 September 1939.

XLIX. A smut on *Dactyloctenium scindicum* Boiss.

A smut on *Dactyloctenium scindicum* (= *Eleusine aristata* Ehrenb.) was collected in the Punjab plains by Mr Sultan Ahmad. It agrees with *Ustilago Eleusines* Syd. (nec Kulkarni), recorded by him (1922) from China on *Eleusine indica*. It has not been possible to compare the specimen with the type but Sydow's description is sufficiently precise

to enable the determination of the Indian specimen as that species. As the specific epithet "*Eleusines*" (an orthographic variant of "*Eleusinis*") had been used by Kulkarni (1922) for an *Ustilago* on *Eleusine coracana*, a new name is proposed for this smut, *Ustilago Sydowiana*, of which *U. Eleusines* Syd. is a synonym.

Ustilago Sydowiana Mundkur nom. nov.

Culmicola, flores complete destruens. Sori 1–2·5 cm. longi, nigri, primo membrana ex hospitis textu cooperti, quae postea dissolvitur, et pulverulentam, nigram sporarum molem revelat; columella conspicua. Sporae globosae, sub-globosae vel leviter ellipticae; episporium tenue, margine glabra sed superficie tenuiter punctulata, colore "Mahogany Red" ad "Chestnut" [Ridgway]; diametro 6·7–11·2 μ, medio inter maximum minimumque 9·1 μ.

Habitat *Dactyloctenium scindicum* Boiss. Punjab Plains, Indiae or.

Culmicolous, entirely destroying the inflorescence. Sori 1–2·5 cm. long, black, at first covered by a membrane made up of host tissue which later disintegrates revealing pulverulent, black spore-masses; prominent columella present. Spores globose, sub-globose to slightly elliptical; epispore thin, with smooth edge but finely punctulate surface; Mahogany Red to Chestnut (Ridgway); diameter 6·7–11·2 μ with a mean of 9·1 μ.

On *Dactyloctenium scindicum* Boiss. (= *Eleusine aristata* Ehrenb.) in the Punjab plains; collected by Mr Sultan Ahmad in 1936. Type deposited in the Herbarium Cryptogamae Indiae Orientalis and co-type in the Herbarium, Imperial Mycological Institute, Kew.

XLIX. (1) *U. Sydowiana*. Type.

Diameter (μ)	6·7	7	8	9	10	11	11·2	
Frequency (n)	1	11	18	106	58	4	2	= 200

Mean = 9·1 μ.

The smut has been compared with *Ustilago Dactyloctaenii* P. Henn., a part of the type specimen having been kindly sent by Dr E. Ulbrich of the Berlin Botanical Museum. *U. Dactyloctaenii* is also culmicolous but its spores are Amber Brown (Ridgway), have a thicker, smooth epispore, and a diameter of 8·5–16·7 μ with a mean of 13·7 μ. The Indian smut is distinct from that species.

L. The covered smut of oats (*Ustilago Kolleri* Wille)

The covered smut of oats occurs wherever oats are grown in India and is the more wide-spread of the two smuts, *Ustilago Avenae* (Pers.) Jens. and *U. Kolleri* Wille, that attack this crop. Sydow & Butler (1906) erroneously placed the Dehra Dun collection of this smut in *U. Avenae* and all later collections were so named until 1934 when the

error was pointed out. Mycologists in continental Europe and North America call it *U. levis* (Kellerm. & Sw.) Magnus, 1894, but according to the Plant Pathology Sub-Committee of the British Mycological Society (1929) the name should be *U. Kolleri* Wille.

Ustilago Kolleri Wille

Ovaricolous; ovaries, basal and inner glumes destroyed. Spores globose to broadly ellipsoidal, Natal Brown to Olive-Brown (Ridgway), light coloured on one side, diameter 4·8–8·7 μ with a mean of 6·4 μ; epispore of medium thickness, but very smooth.

On species of *Avena* (in cultivation) in several parts of India.

Summary

Seventy collections of Indian smuts have been critically examined or re-examined and many of the hosts have been re-identified. Wherever possible the smuts have been compared with type material. The collections are considered to include twenty-five species of which five are proposed as new, namely, *Ustilago Polytocae-barbatae*, *U. Neyraudiae*, *U. Lachrymae-Jobi*, *U. Euphorbiae* and *Tilletia Panici*; two are new combinations: *Tilletia vittata* (Berk.) Mundkur and *Neovossia indica* (Mitra) Mundkur, and there is one new name, *Ustilago Sydowiana*. A smut received from China under the name *Ustilago Coicis* Bref. is reported as a new species of *Tilletia*, *T. Taiana*. An emended description is given of *Ustilago Penniseti* Rabenhorst, with additional notes on *U. Coicis*, Bref., and spore measurements of several non-Indian smuts.

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HETEROGENEOUS FRUCTIFICATIONS IN SPECIES OF *ASPERGILLUS*

By GEORGE HAROLD GOSSOP, EDWARD YUILL AND JOHN LEWIS YUILL

(With Plate V)

Introductory

The investigation, forming the subject of the present paper, was the outcome of an observation made by one of us (G. H. G.) on the behaviour of cultures developing from a mixture of spores of two different mutants from a single strain of *Aspergillus niger*.

It is well known that species of *Aspergillus* show considerable instability and occasionally give rise to mutants when kept in culture. A number of such strains arising by mutation and then maintaining their new characteristics indefinitely have been described. Strains of the species *A. niger* have provided several mutants, among which the most interesting examples for our present purpose are the colour mutants described by Elizabeth Schiemann (1912)—*A. cinnamomeus* and her *A. fuscus*, renamed *A. Schiemanni* by Thom. Another strain of *A. niger* (A. 20) has, in our hands, given rise to a number of colour mutants, one of which (A. 20. M. 1) matches in colour *A. cinnamomeus* and another (A. 20. M. 2) matches *A. Schiemanni*. These are the two mutants referred to in the opening paragraph above. From another strain of *A. niger* (A. 66) we isolated a colour mutant (A. 66. M. 2) having much the same colour as *A. Schiemanni*, and later one resembling *A. cinnamomeus* (A. 66. M. 1).

These facts lead one to speculate whether for every strain of *A. niger* there may not be a potential "*A. cinnamomeus*" and "*A. Schiemanni*".

Spores of the cinnamon-coloured mutant (A. 20. M. 1) and of the brown mutant (A. 20. M. 2) had been inoculated together into a liquid medium and incubated. Mould felts developed and eventually became covered with a sprinkling of spore heads—some of which were cinnamon-coloured and some brown, like those of the cultures A. 20. M. 1 and A. 20. M. 2 respectively. But, in addition, there was a third sort of heads, which were practically black.

This unexpected result we proceeded to investigate.

The possibility that the black spore heads were due to chance infection from *A. niger*, improbable as this seemed from their numbers

and regularity, was excluded by repeating the experiment. Also, they did not exactly match in colour those of A. 20, the strain of *A. niger* from which the mutants A. 20. M. 1 and A. 20. M. 2 were derived. They tended to be larger than the heads of either mutant and frequently had shorter stalks.

Therefore, needle transfers were made from single well isolated examples of the black spore heads on to agar medium. Three sorts of colonies developed: cinnamon-coloured colonies, apparently pure A. 20. M. 1, brown colonies, apparently pure A. 20. M. 2 and mixed colonies often with a "sectored" appearance, showing areas of A. 20. M. 1 and A. 20. M. 2 in juxtaposition (see Pl. V, fig. 1).

We were thus confronted by the fact that the single spore heads from which we had made the subcultures could not themselves have been homogeneous. We believe this is the first instance of this kind recorded for *Aspergillus*.

If the black spore heads from which the agar plates were inoculated, had each contained spores of both mutants, such a result might have been expected, though it may be thought that if this were the true state of affairs, it is somewhat surprising that the original heads should be black. A shade intermediate between cinnamon and brown might not unreasonably have been predicted.

We use the term *heterocaryotic* (for brevity, "*HC*") in referring to these abnormal heads. Their abnormalities must be in some way the result of mixing the two mutants.

Hansen (1938) has reported the occurrence of heterocaryosis in several genera of Fungi Imperfecti. Here the nuclear heterogeneity was found to be in the individual spores which were multinucleate. In the examples we describe, the spores are uninucleate and it is to the spore head as a whole that the term "heterocaryotic" is applied.

Features of mixed or "sectored" colonies

When the "sectored" colonies were more closely examined after some days' incubation, it was found that a number of black *HC* heads had developed and that they were always near the junction of a sector of A. 20. M. 1 with a sector of A. 20. M. 2. Thus, like the original mixed cultures on a fluid medium, "sectored" colonies exhibited three sorts of spore heads: apparently pure A. 20. M. 1 and A. 20. M. 2, within their respective sectors, and black or *HC* heads along the junctions. Further, needle transfers from the apparently pure A. 20. M. 1 heads gave rise to only A. 20. M. 1 colonies, from the apparently pure A. 20. M. 2 heads to only A. 20. M. 2 colonies, but from an *HC* head, to colonies of A. 20. M. 1, A. 20. M. 2 and some mixed colonies, *HC* heads which, in turn, gave A. 20. M. 1,

A. 20. M. 2 and mixed colonies on subculture. Apparently this process could be repeated indefinitely.

$$\begin{tikzcd}
\text{M. 1} \arrow[r] \arrow[d, dash] & HC \arrow[d, dash] & \text{M. 2} \arrow[l] \arrow[d, dash] \\
\text{M. 1} \arrow[r] \arrow[d, dash] & HC \arrow[d, dash] & \text{M. 2} \arrow[l] \arrow[d, dash] \\
\text{M. 1} \arrow[d, dash] & {} & \text{M. 2} \arrow[d, dash] \\
\text{M. 1} \arrow[r] & HC & \text{M. 2} \arrow[l]
\end{tikzcd}$$

Another feature found with some frequency in mixed colonies is the occurrence of what may be referred to as "fused" heads. A "fused" head results when a head of A. 20. M. 1 and a head of A. 20. M. 2 touch and interpenetrate in their early development. Such behaviour is not uncommon with spore heads of a pure strain of *Aspergillus*. When a head of A. 20. M. 1 is found "fused" with one of A. 20. M. 2, the zone of intermingling is marked by the development of more or less blackish colour (see Pl. V, fig. 2), which is of some interest in connexion with the black colour of the *HC* heads. It should be made clear perhaps that with "fused" heads each partner has its own stalk, whereas an *HC* head has only one stalk.

"Parent" and mutant

The results described up to this point followed upon the mingling in some way or another of elements of two species of *Aspergillus* (A. 20. M. 1 and A. 20. M. 2) related to each other by the fact that they are both mutants from one and the same strain of *A. niger* (A. 20).

We next tested what would result from mixed cultures of A. 20. M. 1 with A. 20 and A. 20. M. 2 with A. 20. In both, heterocaryotic heads, not black but some shade of gray or greenish black distinguishable from A. 20, were produced. The *HC* heads on subculture gave rise to mixed or "sectored" colonies.

Extension of the investigation to other moulds

Exploratory experiments with other mutants of *Aspergillus* soon showed that the behaviour described for A. 20, A. 20. M. 1 and A. 20. M. 2 was not confined to this group. Detailed studies of mixed cultures of pairs of a number of available species of *Aspergillus* known to possess mutant relationship were therefore made. In all, heterocaryotic heads, analogous to those first observed, were obtained.

Moulds investigated

The moulds investigated, in addition to the first group, A. 20, A. 20. M. 1 and A. 20. M. 2 already discussed, were:

(2) *A. cinnamomeus* Schiemann. *A. Schiemanni* Thom. (Syn. *A. fuscus* Schiemann).

The above two strains are Elizabeth Schiemann's mutants of *A. niger* and the cultures we used were obtained from the Centraalbureau voor Schimmelcultures, Baarn (Holland) in 1931.

(3) *A. niger*, strain *A.* 66. This strain was isolated by us from an illipe nut in 1937.

A. 66. *M.* 1. This is a cinnamon-coloured mutant which first occurred spontaneously in 1940 as a group of three heads in a culture of *A.* 66.

A. 66. *M.* 2. A mutant from *A.* 66, of about the same depth of colour as *A. Schiemanni*, which appeared spontaneously as a single head in 1939.

(4) *A. nidulans* (Eidam) Winter.

A nidulans mut. *alba*. E. Yuill. This and the previous mould, of which it is a mutant, are described in the *Journal of Botany* for June, 1939.

Culture methods

Except for the first cultures on liquid medium already referred to, agar, or occasionally gelatine, medium in Petri dishes was used. Czapek solution agar was found most generally serviceable, but sometimes an agar medium with the salts of Kardo-Ssyssojewa solution (Kardo-Ssyssojewa, 1936) proved more suitable. Methods of inoculation were employed which insured that spores of any two moulds tested should germinate close to each other. In some experiments, plates were poured with a mixed suspension of spores in melted agar medium; in others, crossing streaks were made on already poured plates with the inoculating loop. Perhaps the simplest method and one of the most effective is to stab the surface of the medium with a needle carrying spores of one of the moulds and to follow this with a similar stab of spores of the other mould in the same spot.

A. cinnamomeus *and* A. Schiemanni

When these two mutants are grown together on Czapek solution agar, *HC* heads in several shades ranging from pale fawn-gray to dead black appear. In the early stages, it is sometimes seen under low magnifications that an *HC* head is made up of chains of conidia of light and dark colours, but uniform colouring is more usual. "Fused" heads showing a dark belt of colour at the junction are also found.

A. niger *strain A.* 66 *and mutants A.* 66. *M.* 1 *and A.* 66. *M.* 2

On Kardo-Ssyssojewa solution agar, A. 66. M. 1 and A. 66. M. 2 grown together give rise to blackish gray *HC* spore heads in a variety of shades. "Fused" heads showing a blackish common zone are also found.

A. 66 and A. 66. M. 1 grown together give dove-gray *HC* heads and "fused" heads not clearly showing a colour change in the common zone.

A. 66 and A. 66. M. 2 grown together on Kardo-Ssyssojewa solution agar produce *HC* heads with freedom. On Czapek solution agar they occur only infrequently. They are found mainly in varying shades of brown and black. Quite early in the process of head production, their composite character can be seen under low magnifications. Such heads present a speckled appearance when young. Even at maturity, it is still fairly easy to see that the chains of spores are not all of one colour. "Fused" heads of the two moulds occur, but do not show any dark zone.

A. nidulans *and* A. nidulans *mut.* alba

Here we are dealing with a green mould and a white mould. The columnar arrangement of the conidial chains, characteristic of the *A. nidulans* group, makes it possible to examine them more easily. Czapek solution agar has been found preferable to other media tested in favouring sporulation and in restricting the growth of sterile aerial hyphae. Mixed cultures develop *HC* heads, which are easily detected under low powers of the microscope and green chains and white chains can both be seen distinctly. Any proportion of white to green chains can occur in *HC* heads. Pl. V, fig. 3, shows a head apparently made up of roughly equal proportions of the two types of spore chains. The columnar arrangement of the chains also allows one to see that the outer chains at least are made up of either green or white conidia throughout their whole length. There is no evidence of the colours being modified by contact of the two sorts.

Conidia, composition of heterocaryotic heads

We have, in the foregoing account, the necessary data on which to form some kind of picture of what we have called the heterocaryotic head. It will be convenient at this point to bring together the relevant facts. The evidence is derived, first, from the results of subculturing *HC* heads, and second, from direct microscopic examination of the *HC* heads or their elements.

Cultural. Entire *HC* heads, transferred and incubated on an agar medium, give rise to mixed colonies, in which spore heads of each of the two moulds which originally produced the *HC* head are found. This demonstrates the heterogeneous character of the *HC* head. Sooner or later, the subculture also shows *HC* heads.

Needle transfers from an *HC* head usually give the same result, but sometimes, only spore heads of one or the other of the original moulds can be found in the subculture; then it may be assumed that the needle happened only to remove spores of one kind.

Single spores, isolated from *HC* heads and grown separately on plates, have never given anything but pure cultures of one *or* the other of the original moulds.

Portions of single spore chains from an *HC* head, removed to plates, developed only pure cultures of one sort or the other.

Microscopic. *HC* heads from mixed cultures of *A. nidulans* and *A. nidulans* mut. *alba* show groups of two sorts of spore chains: some entirely green, some entirely white.

Mixed cultures of A. 66 and A. 66. M. 2 show *HC* heads, which under low magnifications have a speckled appearance, again suggesting spore chains of two colours.

Mounted specimens of *HC* heads from mixed cultures of A. 66 and A. 66. M. 2, also from *A. cinnamomeus* and *A. Schiemanni*, show two sorts of spore chains, one almost colourless, the other strongly pigmented (see Pl. V, figs. 4, 5).

From microscopic appearances, we have no unquestionable evidence that one chain can contain more than one type of spore.

It must be added that some *HC* heads appear so uniform in their spore colour that two types cannot be distinguished microscopically, but only by cultural methods.

The conclusion to which this evidence points is that an *HC* head bears spore chains of two kinds, each of which normally contains spores capable of reproducing only one variety of mould, and this variety is identical with one or the other of the two moulds whose development in mixed cultures produced the *HC* head.

Discussion

Though direct evidence is lacking to show how conidia of two types can come to be borne on one conidiophore, it is not difficult to picture how this may occur. It is obvious that nuclei from both the varieties of mould to be represented in a compound fructification must first have been present in the hypha which produces the conidiophore. We have observed the occurrence of mycelial fusions as *H*-pieces between two different but related mutants of *Aspergillus* (*A. cinnamomeus* and *A. Schiemanni*), so that the path for nuclear migrations is

clear. It may thus happen that nuclei of two different moulds can come to be present in one foot cell and so enter the developing conidiophore. Here repeated divisions occur, providing a supply of nuclei for the primary sterigmata as these are formed; the distribution of the two types would appear to be a matter of chance. As soon as the secondary sterigmata are produced, each will receive a single nucleus resulting from divisions in the primary sterigmata. Both the primary and secondary sterigmata in the moulds discussed are uninucleate (Thom & Church, 1926; Wakayama, 1931). This is true also of the conidia, which are borne by the secondary sterigmata, in which successive nuclear divisions provide each conidium with a single nucleus. [Normally, therefore, one chain of spores can have nuclei of one type only] since the whole chain develops from one sterigma with nuclei resulting from repeated divisions of one nucleus.

It has been made clear that in every experiment so far, in which we have obtained heterocaryotic heads, the two moulds in the mixed culture were related either as mutants of a common "parent" or as "parent" and mutant. The question presents itself whether similar results would be obtained with moulds possessing no mutant relationship. We have made a number of mixed cultures with such moulds, but *HC* heads have never appeared.

It may be asked whether three (or even more) moulds with mutant relationship grown in mixed culture would give rise to heterocaryotic heads containing spores of three (or more) sorts. There seems no inherent impossibility in this, but the chances of the requisite multiple fusions taking place would appear to be less. We have no experimental evidence yet. Such a possibility seems allowed for by Gwynne-Vaughan and Barnes (1930) in discussing fungal anastomoses, where they point out that "fructifications grown under natural conditions may...be compound structures and the product of two or more spores".

Summary

The occurrence, in mixed cultures of species of *Aspergillus*, of fructifications bearing conidia of two sorts is reported.

Such fructifications were formed only when the cultures constituting the mixture were related as different mutants from one strain, or where one mould was a mutant from the other.

The moulds used in this study were various strains of *A. niger*, *A. nidulans*, and a number of related colour mutants.

Evidence, derived from cultural tests and direct microscopic examination, of the dual composition of the fructifications concerned is presented, and an explanation based on mycelial anastomoses is suggested.

ACKNOWLEDGEMENT

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EXPLANATION OF PLATE V

Fig. 1. Plate colony from a single *HC* head of A. 66. M. 1 and A. 66. M. 2, showing sectors of both these mutants.

Fig. 2. "Fused" heads of *A. Schiemanni* and *A. cinnamomeus*. × 44.

Fig. 3. *HC* head of *A. nidulans* and *A. nidulans* mut. *alba*. Note the alternating groups of light and dark spore chains. × 150.

Fig. 4. Portions of chains of spores of two different kinds from a single *HC* head in a mixed culture of A. 66 and A. 66. M. 2. × 500.

Fig. 5. Part of an *HC* head from mixed culture of A. 66 and A. 66. M. 2, showing spore chains of two sorts. × 500.

Fig. 6. Portion of colony from a single *HC* head of A. 66. M. 1 and A. 66. M. 2, showing M. 1 heads, M. 2 heads and one *HC* head. × 70.

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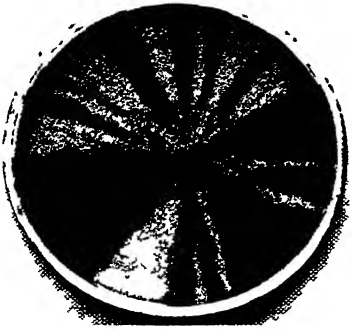

Fig 1

Fig 2

Fig 3

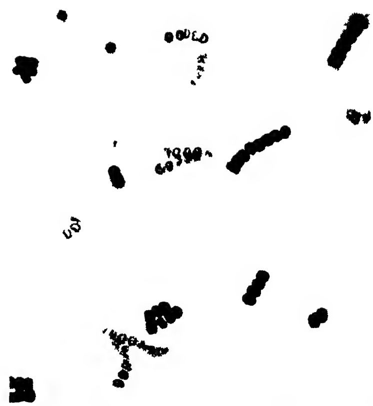

Fig 4

Fig 5

Fig 6

NEW AND INTERESTING PLANT DISEASES

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(With Plates VI and VII)

7. Angular leaf spot of apple

In the first note of this series (Moore, 1939*a*) a short illustrated account was given of a new disease of apple foliage occurring in Surrey and believed to be identical with one described three years before by Wenzl (1936) in Austria. The chief symptom of the disease was the presence on the leaves of numerous, small, very angular spots varying in colour from yellow-green to reddish brown, greyish or whitish grey. A species of *Phyllosticta* and an unidentified fungus were associated with the spotting and the former was identified as *P. angulata* Wenzl, the fungus to which the Austrian disease had been attributed. As pointed out at the time, however, no proof had been obtained by inoculation experiments that *P. angulata* was the cause of the disease.

Recently Wormald (1940) reported the same disease from several other localities in south-east England. A species of *Cladosporium* (probably *C. herbarum*) and a *Phyllosticta* were observed on many of the spots. Pure cultures of the latter were compared with *P. angulata*, and although the two fungi were not identical it was concluded that they "may be merely divergent forms within one species". Wormald did not refer to any inoculation experiments with these fungi, but in an appendix to the article he mentioned the occurrence in Kent in May 1940 of an angular leaf spot on apple and pear trees, which had been proved by the entomologists at East Malling Research Station to be caused by a frog-hopper *Cercopsis sanguinea* Geoff. (*Triecphora vulnerata* Illig.). In size, shape and distribution the spots resembled those associated with the *Phyllosticta* and *Cladosporium* but they were dark brown to reddish brown and not yellowish or silver grey, and no fungus was present on them. Dr Wormald has kindly informed me in a letter, that when the affected leaves were examined later in the year (August) the colour of the spots was then typical of Angular Leaf Spot and some of them bore the *Phyllosticta* and *Cladosporium* that he had found previously. I have obtained identical results at Harpenden with leaves on an apple branch that was covered for a day early in June 1940 with a muslin sleeve, into which a few living specimens of *Cercopsis sanguinea* were placed. The leaves, which showed

the reddish brown angular spots an hour or two after the frog-hoppers had been placed on them, were examined at intervals until August, by which time both *Phyllosticta angulata* and a species of *Cladosporium* were present on the spots. I therefore have no doubt that the disease I described as Angular Leaf Spot is caused primarily by the frog-hopper *Cercopsis sanguinea*, and that the fungi associated with the spots develop saprophytically on the tissues killed by the insect.

8. Leaf spot of lettuce (*Septoria Lactucae* Pass.)

Early in July 1940 an unfamiliar disease was observed on some comparatively mature lettuce plants growing in an open, sunny border of my garden in Harpenden. At first it was restricted almost entirely to the outer, older leaves of the Cos variety Little Gem. Close examination was necessary to detect the earliest stage, which consisted of numerous, irregular, pale yellow areas about $\frac{1}{4}$ in. across, scattered over the leaves. These areas were uniformly stippled with minute brown dots that proved on microscopic examination to be pycnidia of a species of *Septoria*. As the areas became larger many of them developed into conspicuous, rounded, elliptical or irregular, brownish olive spots or blotches up to $\frac{1}{2}$ in. long, surrounded more often than not by a light yellow area, stippled brown (Pl. VI, fig. 1). Pycnidia were present in large numbers on the brown spots. The spotting was noticed first at the end of a long spell of dry and sunny weather, and a few days later, after conditions had become dull and humid, the disease began to make headway. Younger leaves became affected and on the older ones the spots spread inwards towards the main vein, causing large portions of the leaves to become brown and withered. The tissues of many isolated spots fell out, leaving irregular holes, $\frac{1}{4}$ in. or more across, bordered by a narrow, often fragmented band of discoloured tissue bearing pycnidia (Pl. VI, fig. 2). At the end of July the heart leaves alone were unaffected and the plants looked very unsightly. Some of the outer leaves had withered completely and others were badly holed or showed brown and yellow patches.

The pycnidia were amphigenous, spherical or somewhat flattened, 54–120μ in diameter, occasionally up to 180μ in the broadest part, pale brown, with a broad shallow beak of darker brown or almost black cells and a well defined ostiole. The spores were filiform, hyaline, slightly or markedly curved, unicellular or 1–3-septate (mostly 2-celled), with rounded ends, often tapering at one end, and variable in size. In the first specimens collected they measured $19–37 \times 1{\cdot}5–3\mu$ (average length of 25 spores $27{\cdot}5\mu$) but after a week of dull or wet weather most of them were appreciably longer, measuring $29–40 \times 2{\cdot}5\mu$ (average length 35μ).

Seed of the affected variety had been sown rather thickly in two short rows, and the seedlings were planted out in three or four parts of the garden. All the batches were equally affected, including a few left to mature in the seedling rows. The cabbage variety Ideal was also grown but this was free from the disease at first, and though a number of leaves subsequently became attacked, the spotting did not become extensive in this variety. These circumstances suggested that the disease was introduced with the seed of the Cos lettuce, and fortunately the unused portion of this had been kept. 600 seeds taken at random were examined under a binocular microscope and 4–5 % of them showed several pycnidia plainly visible on the surface as small black or blackish dots (Pl. VII, fig. 3). The affected seeds were mostly smaller than the normal ones and many of them were slightly discoloured. A higher percentage may have been affected, for on closer examination many pycnidia not visible externally were found below the testa, and up to thirty-six were counted on some seeds. Though somewhat darker, the pycnidia on the seed resembled those on the foliage in size and form. Most of them were unripe, but mature spores were found in some, and these were similar to those from the leaves and measured 21–34 × 1·5–2μ (average length of 25 spores 27·5μ). The residual seed of the variety Ideal was also examined, but the *Septoria* was not present on it.

I have been unable to find any previous record or material of *Septoria* on lettuce in this country, but have examined several foreign specimens of *S. Lactucae* Pass. in Herb. Kew., including authentic material in Thümen's *Myc. Univ.* No. 1295, which was included in Cent. XIII published in 1879. The original diagnosis on the label to this is:

"Septoria Lactucae Pass. nov. spec. Maculae ferrugineae, irregulares, angulosae, totam folii laminam mox adurentes; perithecia minima, punctiformia, sparsa; spermatia (spora) filiformia, integra, recta vel curvula, hyalina.

"Parma: Vigheffio in foliis vivis languidisve Lactucae sativae Lin. Jun. 1878. leg. Prof. G. Passerini."

The pycnidia in this specimen are 75–125μ in diameter (mostly about 90μ) and the spores, mounted in water, measure 21–37 × 1·5–2·5μ (average length 28·8μ) and are occasionally distinctly two- or three-celled. The Harpenden fungus is identical with it.

What is now generally accepted as the same fungus was described independently by Peck (1879) from North America in June 1879, with the following rather scanty diagnosis:

"*Septoria Lactucae*—Spots indefinite, pallid or brownish; perithecia minute, scattered, blackish; spores straight or slightly curved, ·0008–·0015 of an inch long. Living leaves of lettuce, *Lactuca sativa*. Illinois. Forbes."

In the literature the authority for *Septoria Lactucae* is sometimes given as "Peck" and sometimes as "Pass.", and if Passerini's name is considered to date from the publication of Thümen's *Myc. Univ.* No. 1295 it is difficult to decide between them. Material of *S. Lactucae* Pass. was also distributed, however, as No. 746 in Fasc. xv of the second series of *Erb. Critt. Ital.*, published in October 1878, and if this was accompanied by a diagnosis Passerini is undoubtedly the correct authority for the name. Unfortunately, war conditions have prevented me from consulting the specimens in *Erb. Critt. Ital.*, but *S. Lactucae* Pass. was included without description among *Fung. Parm.* in *Atti Soc. Critt. Ital.* II (1879), p. 34, where reference is made to both exsiccata, and the one in *Erb. Critt. Ital.* is cited first, which suggests that this was the first valid publication.

Six years after Peck had found his *S. Lactucae*, Ellis and Martin (1885) described *S. consimilis* E. & M. on lettuce from North America as follows:

"*Septoria consimilis*, E. & M.—On cultivated lettuce, Geneva, N.Y., July (Arthur), Newfield, N.J. On brown, dead, rather indefinitely limited spots, $\frac{1}{2}$–1 cm. in diameter. Perithecia, brown, subglobose, innate, amphigenous, 90–100μ, scattered over the spots and visible on both sides of the leaf. Spores filiform, multinucleate, slightly curved, ends mostly obtuse, 30–45 $\times$ 2–2$\frac{1}{2}\mu$, hyaline. Differs from *S. Lactucae*, Pass. in growing chiefly on spots, perithecia also a little larger and spores a little longer but not distinguishable by its spores alone."

Shortly afterwards Arthur (1886) pointed out that although *S. Lactucae* Peck was the name in use in North America for the fungus occurring as black or brown specks on the green surface of the leaf, and the form occurring on more or less conspicuous spots was referred to *S. consimilis* E. & M., there was no essential difference between these fungi, and as soon as it was realized the spots were merely incidental to the disease the name *S. consimilis* E. & M. dropped into synonymy. As already stated, however, *S. Lactucae* Peck was antedated in all probability by *S. Lactucae* Pass. and pending confirmation of this* the latter is regarded as the valid name of the lettuce Leaf Spot fungus occurring both in Europe and North America.

Among other specimens of *S. Lactucae* Pass. in Herb. Kew. one is from Sydow, *Mycoth. marchica* No. 2377, collected on *Lactuca sativa* in Germany in 1888, and one in Ellis, *N. Amer. Fungi* No. 345, on leaves of garden lettuce in October 1879. Both these are identical with Thümen's No. 1295. Another specimen, from Roum. *Fungi Gall. exsicc.* No. 2032, occurs in definite spots on *Chondrilla muralis* and seems to be distinct. Very few spores could be found but the

* See Note, p. 350, at the end of this article.

pycnidia are black, more uniform in size and smaller (66–78μ in diameter) than those typical of *Septoria Lactucae* Pass.

There is also in Herb. Kew. a specimen from Thümen's *Myc. Univ.* No. 2095, collected on *Lactuca sativa* at Skaarup in Denmark in September 1881 and named *Ascochyta Lactucae* Rostr. nov. spec. Von Thümen had added to the diagnosis of this the observation "meae sententiae Phyllostictae species", but the fungus is undoubtedly a *Septoria*, indistinguishable from *S. Lactucae* Pass., as already pointed out by Neergaard (1938), who demonstrated moreover that Rostrup had included two fungi under the same name. Rostrup's (1902) description of *Ascochyta Lactucae* Rostr. clearly applies to a fungus collected at Copenhagen in 1894. It is a true *Ascochyta* which was described as *A. suberosa* in notes left by Rostrup, and was published by Neergaard as *A. suberosa* Rostr. nov. sp. in litt.

It is rather surprising that *Septoria Lactucae* Pass. has not been seen in England previously, for it is evidently very widely distributed elsewhere, and in addition to Italy, Germany, Denmark and North America it has been recorded on *Lactuca sativa* from France (Sacc. *Syll.* 3, 551), Japan (Nisikado *et al.* 1938), China (Tai 1937) and the Argentine (Hauman-Merck 1915), on *Lactuca* sp. in India (Butler & Bisby 1931) and on *L. scariola* and *L. virosa* in Germany (Rab. *Krypt. Fl.* 1, 6, 1901, p. 800). It was also listed on *L. scariola* by Thorne (1892) in Ohio and by Ranojević (1914) in Serbia.

Grateful acknowledgement is due to Miss E. M. Wakefield and Miss F. L. Stephens for information about the earlier records of *Septoria* on lettuce.

9. A DISEASE OF *COLCHICUM* CORMS CAUSED BY *PYTHIUM ULTIMUM* TROW

The available information about diseases of *Colchicum* has been summarized by Moore (1939*b*, p. 57), but it is very scanty and several troubles known to exist have never been studied scientifically. One of these came to my notice late in July 1940, when a number of diseased corms were received from the nursery in Buckinghamshire where a root and bulb rot of tulips due to *Pythium* had been observed the previous year (Moore, 1940). Investigation showed that the Colchicum disease was caused by *P. ultimum* Trow, one of two species that had proved to be responsible for the tulip rot. The disease is of annual occurrence in *Colchicum speciosum album* and commonly occurs in *C. byzantinum*. It has also been seen in the newer hybrid varieties President Coolidge and Lilac Wonder, but *C. speciosum* var. *illyricum* appears to be highly resistant to it. It is often late in July before the big fleshy stems of *Colchicum* have become dry enough to part readily

from the corm and so allow the corms to be lifted without risk of damaging them. They are then replanted at the earliest convenient time in August. The disease is generally noticed first after lifting, but rotting starts while the corms are still in the ground. Indeed, some corms are completely disorganized when lifted. Less badly affected ones are wet and sticky below the outer brown skin, which must be removed before the full extent of the damage can be seen. Infection does not appear to take place through the roots, as in tulips, but at the outside of the corms, probably through wounded tissue.

On the side or at the top of the diseased corms examined, there was a crater-like hole 1–1½ in. across, partially filled with soft, wet and rotten tissue. The skin of the corm around the hole was either white and sound, or soft, slightly sunken and pale greyish brown for distances up to 1 in. When the corms were cut through, much or most of the flesh below the completely disorganized mass was found to be soft and discoloured. When first cut the flesh was greyish with a distinct pink or brown tinge, but on exposure to the air the colour usually deepened rapidly and became brown, reddish brown or even blackish. In one corm only slightly attacked the rot had evidently begun at a wound on the side of the corm and had spread in the superficial tissues to produce a pale chocolate-brown band ½ in. wide extending from the top of the corm to the basal plate (Pl. VII, fig. 4). Saprophytic moulds including *Penicillium* developed on the badly decayed parts but a phycomycetous fungus was present everywhere in the affected tissues. This was isolated in pure culture and identified as *Pythium ultimum* Trow. Preliminary inoculation experiments were carried out with it and with another strain of *P. ultimum* obtained from a naturally infected tulip bulb. Both strains induced Watery Wound Rot in Duke of York potato tubers inoculated through wounds and kept three days in moist dishes at 22° C., and both produced rotting in tulip bulbs under similar conditions. A rot resembling that in naturally infected corms was also induced in *Colchicum byzantinum* by both strains, but it developed much more slowly than in tulip bulbs. At the end of a fortnight it had spread, either internally for distances up to 1 in. from the spot inoculated, or superficially in a band ¼ in. wide running from top to bottom of the corm through the place of inoculation. *C. speciosum album* was also successfully infected but none of the eight corms of *C. speciosum* var. *illyricum* inoculated showed the slightest sign of attack.

Note. Confirmation has since been obtained that *Septoria Lactucae* Pass., antedates *S. Lactucae* Peck. A specimen of No. 746 *Erb. Critt. Ital.*, in Herb. Mus. Brit., is accompanied by a diagnosis almost identical with that on the label to Thümen's *Myc. Univ.* No. 1295.

Fig. 2

Fig. 1

Fig. 3

Fig. 4

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EXPLANATION OF PLATES VI AND VII

PLATE VI

Fig. 1. Leaf of Cos lettuce var. Little Gem showing early stage of attack by *Septoria Lactucae* Pass. Note the stippled area around some of the spots.

Fig. 2. Another leaf showing Shot-hole effect and stippling on the right-hand margin of the leaf.

PLATE VII

Fig. 3. Lettuce seed bearing pycnidia of *Septoria Lactucae* Pass. × 14.

Fig. 4. Corm of *Colchicum byzantinum* attacked by *Pythium ultimum* Trow. The outer brown scale that normally covers the corm was removed before the photograph was taken.

(*Accepted for publication* 10 *October* 1940)

A METHOD OF ISOLATING SOIL FUNGI

By C. G. C. CHESTERS

(With 1 Text-figure)

While many methods of isolating fungi from soil have been described from time to time, the majority in use at present fall into two categories.

I. Direct isolation from particles of soil scattered over the surface of sterile media. The medium may be taken to the soil to be investigated in sterile tubes or Petri plates, or the soil may be brought to the laboratory in sterile containers.

II. Indirect isolation from a suspension in sterile water containing mycelial fragments and spores which is prepared in known dilutions from the soil examined.

It seemed possible that fungi could be isolated from the soil *in situ* on sterile agar or sterile plant tissues if these could be successfully introduced into the soil without previously being exposed to aerial contamination. Such a method would permit the infection of the agar under actual conditions of soil moisture and temperature, and by using a wide range of media it might prove possible to isolate from the soil fungi not normally obtained from either soil particles or suspensions. The method would require to be simple, fast enough to allow rapid isolation, and capable of giving results at least as accurate as either of the other two methods.

In November 1939 specially designed tubes to hold either agar or solid plant media were constructed, and the results obtained after 9 months' trial suggest that the use of these *immersion tubes* may provide a more precise method of investigating the fungal flora of the soil. Extended reports of investigations using these tubes will be published shortly, but a brief description of the construction of the tubes may be useful to research workers dealing with soil problems.

Immersion tubes can be prepared from either hard-glass test-tubes or from any diameter hard-glass tubing that may meet individual requirements. Each tube has several small holes blown in the lower half of its length. These may be flush with the wall or may extend inwards as capillaries, varying in length and direction as the particular problem requires. The construction of three types will be described, but many modifications are now being experimented with and will be reported on at a later date.

Type I. Direct contact immersion tubes (Fig. 1 A).

This tube has nine holes arranged in a spiral in the lower half of the tube. Each hole is about 0·5 mm. in diameter, and is prepared by drawing a spicule from the wall of the test-tube, cutting it flush with the wall, reheating till the glass has fused round the raw edge, and finally adjusting the diameter of the hole with a warm waxed needle-point to the size required. Each tube must be very carefully annealed after the holes have been graduated.

Capillary type immersion tubes

Type II. Standard pattern (Fig. 1 B).

This type of tube has been most successful for general purposes, and is prepared from a pointed 6 in. × $\frac{3}{4}$ in. hard-glass test-tube. It differs from the former in the fact that it has only six external openings which lead into short tapered, internal capillaries. These are made by heating a localized area of the tube wall, drawing a short capillary side tube, cutting this about 2 mm. from the tube wall, carefully reheating and, when the glass is molten, invaginating the capillary with a warm, waxed needle-point. These tubes require very careful annealing, and the capillaries must be made in rapid succession.

Type III. Special pattern (Fig. 1 E).

This type of tube was prepared for isolating Phycomycetes. It is made from 1 in. internal diameter hard-glass tubing which is cut into 4 in. lengths, each with a tapered point at one end. A bulb with a diameter of about $1\frac{1}{2}$ in. is blown at this end, and three or four internal capillaries are drawn in the wall of the bulb. Each capillary ends at the same level inside the tube just beyond the top of the bulb. These capillaries are prepared by heating a localized area of the bulb wall until the glass is molten, and then attaching a tapered glass rod on the inside in the centre of the molten area. After removing the bulb from the flame a capillary is slowly drawn upwards on the end of the glass rod. When the capillary is cool the rod is easily snapped off and the capillary graduated to the required length. When all capillaries have been made the bulb is annealed in a soft flame, which gradually fuses the ragged edge at the inner apex of each capillary.

Immersion tubes are sterilized and filled with media while enclosed in a container tube (Fig. 1 D). They are sterilized in an autoclave. Tubes are filled to just above the highest capillary with almost cool nutrient agar. If solid plant materials are used these may be packed into the immersion tube while it is enclosed in its container and the whole apparatus sterilized in an autoclave. Tubes may be filled with

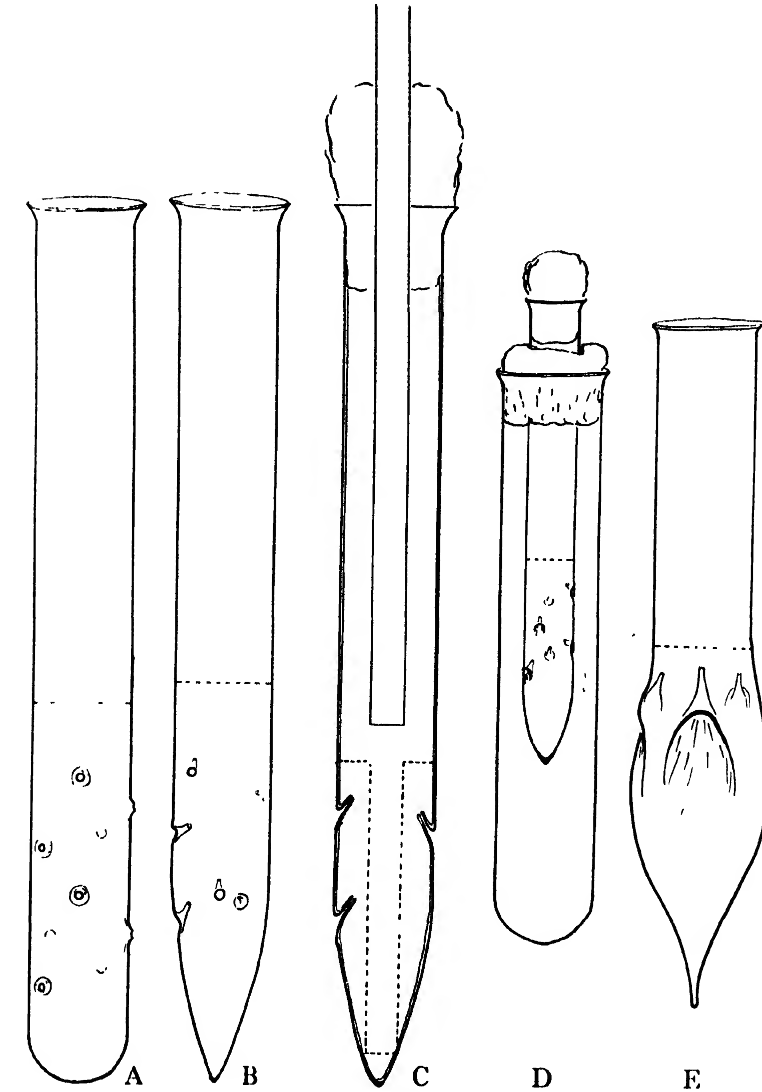

Fig. 1.

a hollow cylinder of agar by immersing a sterile rod into the almost cool agar and withdrawing it after the agar has set (Fig. 1 C).

Immersion tubes are carried to the soil to be examined while still in their containers. The tube is immersed in the soil by quickly withdrawing it from the container and pushing it down into the soil to the required depth. Each tube is covered by a small specimen tube to keep the cotton-wool plug dry. Tubes are normally allowed to incubate in the soil from 7 to 10 days, and are then quickly removed to the laboratory in fresh sterile containers. The colonies which have developed on the medium opposite the capillaries are subcultured to fresh sterile medium in the normal manner.

A wide range of fungi has already been isolated by this method.

(*Accepted for publication* 15 *October* 1940)

A NOTE ON LONGEVITY IN *XYLARIA*

In September 1924, during some experiments with *Dacryomyces deliquescens* (Bull.) Duby, pieces of wood about an inch in diameter and six inches long were thrust to a depth of five inches into damp garden soil. By the end of October, a piece of elm, cut from a fallen branch, bore ten well-developed stromata of *Xylaria Hypoxylon* (Fr.) Grev. It is possible that the dead elm wood already contained the mycelium of the fungus when it was cut and pushed into the soil, but there were no external signs of this.

The piece of elm was left undisturbed until 1938, and it bore, every autumn, a crop of up to a dozen healthy stromata. In December 1938, the wood was transferred to a shady spot in another garden. It then bore the remains of the eight stromata formed in 1938, and had been reduced by the rotting of the more deeply buried end to about one half of its original length, though the top inch which had always been above the level of the soil was still fairly hard. In the new situation five stromata developed during the autumn of 1939, and on 25 September 1940, the beginning of activity for the seventeenth successive autumn was noted, signs of growth being apparent at the bases of two of the old stromata.

In January 1931, one large stroma of *Xylaria polymorpha* (Fr.) Grev. was found on a dead stump of *Prunus Laurocerasus*. The stump was rather more than two inches in diameter, and the wood seemed hard and sound. A piece about eight inches long was sawn off and this was set in the ground, with the base of the stroma just above soil level, close to the *Xylaria Hypoxylon*. In the autumn of 1931, a single large stroma of *X. polymorpha* grew, and in 1932, two small, poorly grown stromata were seen. Subsequently, the fungus showed no activity. The stump was left in position until December 1938, and then contained at least four times as much hard wood as was present in the piece of elm, so that the failure of *X. polymorpha* to appear after 1932 can hardly have been due to lack of nutriment.

B. BARNES.

NOTE: LARGER FUNGI IN THE TROPICS

In connexion with the article which appeared in these *Transactions* (XXIV, 1940, 64–67) entitled "Some problems of collecting larger fungi in the tropics" by G. B. Masefield, I wish to correct some false impressions which may be gathered. Mr Masefield suggests that large fleshy fungi are scarce in numbers and variety in the tropics generally, and states that he has seen no *Boletus*, *Lactarius* or *Russula* in the tropics, and that *Amanita* seems not to occur. These conclusions do not agree with my experience in Malaya, and I would refer to my article on "The seasonal fruiting of Agarics in Malaya" published in the *Gardens' Bulletin*. Straits Settlements, IX, 1935, 79, where the answers to many questions raised by Mr Masefield will be found. I would generalize from my Malayan experience for the whole of tropical Asia and Australasia by saying that larger fungi are abundant numerically, specifically and generically but that their fructifications are seasonal, developing quickly and rotting quickly, during the first rains which follow dry weather, and that if one is not able to visit the forest daily during the right fortnight, no trace of these fungi will be found. As for variety, I have found in Singapore some sixty species of *Boletus*, twenty-six species of *Russula*, twenty species of *Hygrophorus*, fourteen species of *Amanita*, ten species of *Amanitopsis*, thirty species of *Lepiota*, fifteen species of *Psalliota*, twelve species of *Tricholoma*, twenty species of *Clavaria*, and about seventy species of *Marasmius*. One species of *Amanita* has a pileus 20 cm. wide with purple-brown warts 1·5 cm. high: another has a stalk 26 cm. high and a pileus 22 cm. wide and another has a pileus 1 cm. wide and a stem 2 cm. high. Likewise there is a *Boletus* as massive as *B. Satanas* and another as slender as a *Mycena* (*Filoboletus*): some are green, others grey, brown, yellow, red or purple. The species of *Amanita* are related to *A. muscaria*, *A. pantherina* and *A. strobilaeformis*. There is a *Tricholoma* related to *T. decastes* which also grows in large marshes, and another which grows below high-tide level in the mangrove swamps. Perhaps the most spectacular is an Oxford blue *Entoloma* which may reach 12 cm. across the pileus. These examples will prove the idea that tropical conditions are unsuitable for higher Basidiomycetes to be mistaken.

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Erratum

Watson, Mr W. 1923, not 1933.

INDEX

New names are indicated by an asterisk.

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